Journal of FORESTRY

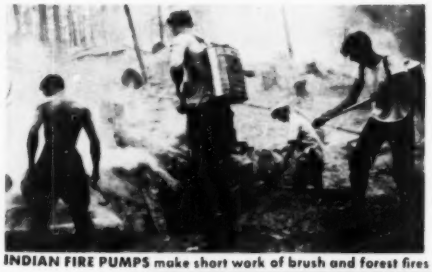
DECEMBER 1951

SOCIETY OF AMERICAN FORESTERS 1900

Volume 49
Number 12
(Including Index)

THE SMITH INDIAN FIRE PUMP

A ONE MAN FIRE DEPARTMENT FOR EXTINGUISHING INTERIOR AND OUTDOOR FIRES



INDIAN FIRE PUMPS make short work of brush and forest fires

Protect property and guard lives with *Indian Fire Pumps* — the world's greatest fire fighters. *Indians* are unsurpassed for fast, efficient fire fighting. Big 5 gal. air conditioned tank carries either by handle or slung on back. Only clear water used. First choice of foresters, fire departments, lumbermen campers, etc.

***Indian Fire Pumps* are ideally suited for Civil Defense. Thousands were used in World War II. Portability on the back leaves arms and hands free. *Send for circular* giving full details.**

No. 147 ADJUSTABLE SOLID BRASS NOZZLE FOR INDIAN FIRE PUMP

Precision built and made of solid brass throughout. Instantly adjustable for 30-40 ft. strong stream or long distance spray. Also makes a beautiful fog mist. This nozzle screws on any *Indian Fire Pump*.

THE SMITH INDIAN BACK FIRING DRIP TORCH

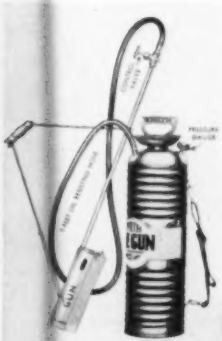
Endorsed by foresters, fire depts., loggers, railroads, etc. Developed after extensive field research. Widely used for slash disposal, burning right of way, etc.

1 gal. tank. Seal tight handy filler cap. Brass feed pipe. Strongly built.

Send for circular.

THE SMITH FLAME GUN

HUNDREDS OF USES



2000 degrees controlled heat. Destroys weeds, brush, rubbish. For burning safety strips and fire lanes. 4 gal. tank. 7 ft. oil proof hose. Light. Compact. Portable. Burns kerosene or range oil.

Folder on Request

THE SMITH INDIAN DRINKING WATER SUPPLY TANK

5 Gal. Capacity Armco Zinc Grip Steel Tank

For carrying drinking water to construction, fire fighting or road crews. Also used for refilling Indian Fire Pump tanks on the fire line. Large opening for easy filling. Push button faucet. Carries by handle or slung on back. Air conditioned tank.

RETURN COUPON FOR LITERATURE DESCRIBING THESE AND MANY OTHER SMITH PRODUCTS

407 MAIN ST. UTICA 2, N.Y.

PACIFIC COAST BRANCHES

Hercules Equipment & Rubber Company, Inc. 435 Brannan Street San Francisco 7, California

Fred E. Barnett Company 2005 S. E. 8th Ave. Portland, Oregon

Titan Chain Saws, Inc. 2700 Fourth Avenue South Seattle, Washington

Roy G. Davis Company 617 East Third Street Los Angeles, California

Fred E. Barnett Company 600 Spring Street Klamath Falls, Oregon

L. N. Curtis & Sons 426 West Third Street South Salt Lake City, Utah

CANADIAN AGENTS:

Fleck Bros. Limited 110 Alexander Street Vancouver, B. C., Canada

C. E. Hickey & Sons, Ltd. Hamilton, Canada

D. B. SMITH & CO.

407 MAIN ST., UTICA 2, N. Y.

Please send me descriptive catalog on your entire line.

NAME .....

ADDRESS .....

CITY ..... **STATE** .....

VOLUME 49 ● NUMBER 12 DECEMBER 1951

Journal of Forestry

Editorial Staff

ALBERT G. HALL ..... *Editor*

HENRY CLEPPER ..... *Managing Editor*

L. AUDREY WARREN ..... *Business Manager*

Associate Editors

HAROLD H. BISWELL, *Range Management*, School of Forestry, University of California, Berkeley 4, Calif.

C. FRANK BROCKMAN, *Forest Recreation*, College of Forestry, University of Washington, Seattle 5, Wash.

CHARLES C. BUCK, *Forest Fire*, California Forest and Range Experiment Station, P.O. Box 245, Berkeley 1, Calif.

ALBERT C. CLINE, *Forest Economics and Policy*, Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

S. R. GEVORKIANTZ, *Mensuration*, Lake States Forest Experiment Station, University Farm, St. Paul 1, Minn.

W. D. HAGENSTEIN, *Forest Management and Engineering*, Forest Conservation Committee of Pacific Northwest Forest Industries, 1410 S. W. Morrison Street, Portland 5, Oreg.

GEORGE H. HEPTING, *Forest Pathology and Entomology*, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Federal Building, Asheville, N. C.

HERBERT B. MCKEAN, *Forest and Wood Utilization*, Timber Engineering Company, 1319 18th Street N. W., Washington 6, D. C.

CARL E. OSTROM, *Silviculture*, Southeastern Forest Experiment Station, Asheville, N. C.

J. W. B. SISAM, *World Forestry*, Faculty of Forestry, University of Toronto, Toronto, Ont., Canada.

H. G. WILM, *Forest Influences and Soils*, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Oreg.

LEE E. YEAGER, *Forest-Wildlife Management*, Colorado Cooperative Wildlife Research Unit, 115 Forestry Building Colorado A & M College, Fort Collins, Colo.

LLOYD THORPE, *Advertising Representative*, 209 Seneca Street, Seattle 1, Wash.

The JOURNAL OF FORESTRY, established in 1917, is the official organ of the Society of American Foresters, but the Society assumes no responsibility for the statements and opinions expressed by contributors.

Publication office, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Address all correspondence concerning editorial or business matters to JOURNAL OF FORESTRY, 825 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Published monthly. Subscriptions $6 per year; single copies 60 cents. Missing numbers will be replaced without charge provided claim is made within thirty days after date of the following issue.

The editors are not responsible for loss or damage of manuscripts and photographs while in transit or in their possession. All material submitted for publication should be accompanied by return postage.

Copyright, 1951, by the Society of American Foresters. Entered as second-class matter at the post office at Washington, D. C. Acceptance for mailing at the special rate of postage provided for in the Act of February 28, 1925, embodied in Paragraph 4, Section 412, P. L. and R., authorized November 10, 1927.

CONTENTS

COVER: Christmas Tree Harvest—Halvorson Trees, Duluth, Minn.
Photo by: Caterpillar Tractor Company

Editorial—Forestry and Our Wood Supply 867
George Banzhaf

Snow Accumulation and Retention on Ponderosa Pine Lands in Idaho ..... *H. F. Haupt* 869

An Objective Look at the Vegetation-Stream Flow Relationship ..... *Richard S. Sartz* 871

Full Utilization and Available Markets the Key to Intensive Forestry in the Pacific Northwest ..... *Clyde S. Martin* 875

Yield and Quality of Jack Pine Pulpwood Produced on Different Types of Sandy Soil in Wisconsin 878
S. A. Wilde, Benson H. Paul, and *Pietsa Mikola*

The Hydrologic and Climatic Influence of the Forest is Basic to the Concept of Forestry 881
Raphael Zon

Thinning in Old-Field Virginia Pine 884
William D. Miller

Yellowpoplar Lumber Grade Yield Recovery—A Guide to Improved Cutting Practices 888
Gilbert H. Fechner

Effect of 2,4-D, 2,3,5-T, and Sodium Trichloroacetate on Gallberry 895
L. K. Halls and *G. W. Burton*

New Trends in Range Soils *W. G. McGinnies* 897

Pine Marten as a Forest Product 899
William H. Marshall

Effect of Grazing on Floristic Composition and Soil Properties of Farm Woodlands in Southern Wisconsin ..... *E. C. Steinbrenner* 906

Composting Coarse Hardwood Sawdust With a Bacterial Accelerator 910
C. S. Walters, H. W. Fox, and *H. B. Wycoff*

Notes 912

Water Resources and the National Park System; Physical Properties of Brown Forest Soils After Felling; Observations on Litter Fall and Foliage Nutrient Content of Some Pacific Northwest Tree Species; Southern Pines from Different Geographic Sources Show Different Responses to Low Temperatures; Random Sampling within Circular Plots by Means of Polar Coordinates; Figured Walnut Propagated by Grafting; More on Bear Damage: Pack Rats.

We Present—Dr. C. Audrey Richards 918

Reviews 920

Forest Fires in the Northern Rocky Mountains; The Closing of the Public Domain; Disposal and Reservation Policies, 1900-1950; Ohio Maple Syrup—Some Factors Influencing Production; Some Fundamental Plant-Soil-Water Relations in Watershed Management; Cooperative Forest Fire Control; Forestry in Farm Management; An Annotated Bibliography of Aerial Photographic Applications to Forestry; Conservation of Forest Resources.

Current Literature 925

Society Affairs 926

Forestry News 933

Get Faster Cutting Longer with a

HOMELITE

One Man Chain Saw

More Power Per Pound Than Any Other Saw

Less Down Time Than Any Other Saw

There are two big plus factors in favor of a Homelite Chain Saw. First, it's the only saw weighing as little as 27 pounds that has a 4 horsepower engine. And second, field tests under severe operating conditions have clearly shown that a Homelite needs less down time for maintenance or repairs than any other saw.

Put these factors together and you get everything you want in a saw . . . easier handling, faster cutting and lower maintenance cost. Built and backed by Homelite, manufacturers of more than 300,000 gasoline engine driven units, this saw will perform easily and perfectly on every type of cut. Try it once and you'll use it always. Send for complete information.

Manufacturers of Homelite Carryable Pumps • Generators • Blowers • Chain Saws

PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE

CORPORATION

4112 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Journal of Forestry

Official Organ of the Society of American Foresters

Forestry And Our Wood Supply[1]

George Banzhaf

Forest consultant, Milwaukee, Wis.

The close and vital relationship between forestry (and foresters) and our national wood supply is steadily becoming more apparent to thinking citizens. The picture of the forester as a militant advocate of reform is gradually fading and in its place the public will expect to see a competent technically trained man who is assuming responsibility for one of our basic natural resources.

FOR DECADES foresters engaged in a missionary campaign. They were quite properly critical of the policies followed by the forest industries in years past and pleaded for a chance to show what they could do. In my opinion, foresters have largely completed the "sales" phase of their work so far as the general public is concerned. The public has been sold a bill of goods (of sound value) and it is now time for the forester to consider the practical economic problems by which he is confronted. A great deal of industrial sales work remains to be done but, to a rapidly increasing degree, foresters are being given charge of industrial forests and of the procurement of raw materials for use by the forest industries. Are foresters equipped by training, temperament, and point of view to handle the job properly? Innumerable young men have told me that they entered forestry because they loved the outdoors and because they liked to hunt and fish. Yet the practice of forestry is not a prolonged outing nor is a forester an advanced eagle scout—he is a man upon whom has been thrust a responsibility which he must capably assume.

We are all familiar, and we all agree, with the theory of multiple use. The place of forestry in erosion and watershed control, in game management and recreation, is well recognized. Those are all important fields and the men engaged in them are doing vitally important work. Yet from the standpoint of the public, the ultimate worth of forestry is likely to be judged by its ability to perform a purely economic function. Can it produce the permanent supply of wood that is required to maintain our forest industries—that is necessary if the United States is to remain on a roster of "have" (as opposed to "have not") nations?

It may be unfair to charge foresters with the responsibility for producing an adequate supply of wood after the forest capital has been badly depleted by wasteful predecessors. That feeling is understandable but it is beside the point. Doctors and consultants are brought into situations to diagnose the difficulty and to prescribe remedies. If the patient, human or corporate, were not sick they would not be called in. The existence of the problem creates the opportunity for service.

To the forest industries, forestry is largely a matter of economics. Large paper mills, for example, cannot afford to follow the "cut out and get out" philosophy of an earlier and simpler day. They are tied to the forest by the strongest of chains—their multimillion dollar plant investments. "Where your treasure is, there lies your heart also." And no plant investment is any better than its raw material supply. Nothing is more costly than an idle mill. The following statement made by a prominent paper mill executive in 1948 aptly illustrates the point:

> Tomorrow's wood supply is today's most important problem in our industry. Adequate and constant pulpwood supply is the basis for continuous operation and future planning. An assured supply of pulpwood is a firmer foundation for a pulp and paper mill than the bed rock on which it rests.

As a matter of plain fact, the teachings of forestry made little impression on industry until the wood supply problem made forestry good business. And it is probably fair to say that forestry is chiefly attractive to industry where species, climates, or markets make short rotations possible. The forestry objective must not only be definite, but attainable in the easily foreseeable future.

The forest industries are looking for constructive leadership in the solution of their raw material problems. Top management officials have largely come up through the production, sales, financial, or legal departments of the business. Very few top executives have come up through the woodlands department (although this situation is gradually changing) and they, therefore, do not always understand the problems of wood supply, although they are deeply conscious of the critical importance of a sustained flow of wood. They are, therefore, employing foresters in increasing numbers and are assigning to them the problems of wood production and procurement together with the vital problems of long range planning to safeguard the future. All this does not mean that we will be

[1]Adapted from a paper given at the Golden Anniversary Meeting, Society of American Foresters, Washington, D. C., December 16, 1950.

surrounded by managed forests overnight, but it does indicate a trend in industrial thought that should not be understimated.

If foresters are to assume responsibility for our national wood supply, it is time that they engaged in a bit of group re-appraisal. It has long seemed to me that foresters have not been sufficiently self-critical. There has been more than a trace of self-satisfaction and self-righteousness. As a result, there has been a tendency toward crystallization of professional thought. There has been a cherishing of classical forestry concepts that may or may not apply to the problems at hand. Professional thought must be dynamic if it is to realize its potential for constructive service. Many foresters are obsessed by the idea that forestry must, above all things, be recognized as a profession. It should be remembered that a vocation is elevated to the rank of a profession as a result of public esteem and appreciation and not through self-designation. Foresters must be technically capable but they must also have a broad outlook. One valid criticism of forestry education may well be that it is not broad enough. Forestry needs truly educated men.

It has always seemed strange to me that foresters, as a group, have never taken the interest in forest products markets that the subject calls for. Markets are a controlling factor in any cutting plan. Of necessity, a private firm must conduct its operations with due regard to both costs and markets. And the forester in charge of those operations must be familiar with both. This requirement does not apply only to industrial foresters. Public foresters should be equally conversant with the forest economics of their territories. They should understand not only their forests, but also the products that are produced from those forests and the trade channels through which they flow.

Management plans and cutting practices reflect the economic realities of the time and of the region. The forest manager must, above all, be flexible in the application of his knowledge. A federally administered regulatory law, for example, is not a panacea for forest problems for it only creates rigidity, where flexibility is the price of survival in a free enterprise economy. Having mentioned that much abused phrase, "free enterprise," I might add that foresters, as well as other professional men, would do well to study the nature of a free enterprise economy as well as the meaning of the word "freedom" itself. Nothing could be further from the truth than the quaint notion that a free enterprise system, properly controlled by a beneficent government, can be profitable for everybody. It should never be forgotten that freedom and risk go hand in hand. Our generation has become hypnotized by the mirage of security.

If a forester is to be flexible, if he is to adjust himself readily to changing conditions, he must keep abreast of what is happening in his field. We have had courses in wood utilization in college but the subject of wood use is not a static thing. It does not remain comfortably unchanged. It is changing all the time, and foresters, who think in terms of national wood supply, must change with it.

Let us take the subject of aspen as an example. Regarded as a weed tree not long ago, this species is now one of the most active items on the pulpwood market in the Lake States. The silvicultural problems of aspen, as a transitional type, can be bypassed for a moment. The important point is that a former weed species suddenly developed a volume market of tremendous importance to the forest manager in the northern Lake States.

And, of course, the forest manager must think not only in terms of species but also in terms of products. Many foresters have taken for granted that the climax forest product—if I may use that term—is a saw log or a veneer log. Yet instead of logs, foresters may be called upon chiefly to produce wood fiber in volume. We have heard much of the need for putting existing virgin forests under management. Yet in the Lake States, where much of my work centers, the chief forests are second growth forests and relatively little is known about them. In the case of transitional forest types like aspen, what is the rate of transition regionally and what will the climax forests be? What are the potentialities of balsam fir as a long fibered species? At what age does the amazingly aggressive sugar maple produce seed? Some of us believe that the future forests of the Lake States will be pulpwood forests, that even the hardwoods will be managed on extensive areas for pulpwood production, or perhaps for combined pulpwood and saw log production. What management practices will be followed? There is so much to be learned that we do not know.

In the world of sport we are familiar with the term "old pro" denoting not only competence but an awarness of the practical realities. The forester too, should strive for combination of technical and practical competence; he should know the "facts of life" in his field. If foresters are to be regarded as professional men then let them be "professionals" in the fullest sense of that term.

Snow Accumulation and Retention on Ponderosa Pine Lands in Idaho

H. F. Haupt
Range conservationist, Intermountain Forest and Range Experiment Station, Ogden, Utah.

THE GENERALLY STEEPLY SLOPING ponderosa pine lands of south central Idaho are a major source of runoff to tributaries of the Snake River. These lands yield the bulk of their runoff during the spring snow melt period, the streams falling to low stages in the summer and fall months when water is most needed for irrigation and power. Any increase in the amount of snow stored or any delay in the time of melting that can be accomplished on these forest lands should benefit downstream water users by prolonging the recession of stream flow.

In the early thirties, Connaughton[1] found snow storage to be greatest and snow melting slowest in openings between large, mature trees and in stands of young growth on ponderosa pine lands having level terrain. Additional observations of snow accumulation and melting were made on more typically steep ponderosa pine lands at elevations of 4,000 to 5,000 feet in the Boise Basin Experimental Forest near Idaho City, Idaho during the winter seasons of 1935, 1936, and 1937. These observations have shed further light on snow accumulation and its persistence as affected by slope aspect and various conditions of plant cover normally found in uneven-aged virgin ponderosa pine forests of that part of Idaho.

Snow Measurements

The water content of the snow pack was measured with a Utah snow tube sampler every 15 days from January 1 to April 15 during the 3-year study period at 258 sampling stations. These stations were located at 100-foot intervals along parallel transects 1 mile apart. The number of sample stations that fell on the four cardinal slope aspects were: North, 55; East, 52; West, 76; and South, 75. The sampling stations were further classified by plant cover conditions as follows:

Mature stand, where station occurred within 25 feet of the crown of a mature or overmature tree.

Pole stand, where station occurred within 8 feet of the crown of a pole-size tree.

Sapling stand, where station occurred within 6 feet of the crown of saplings and reproduction.

Small brush opening, where station occurred in brush patches having a diameter of from 60 to 160 feet.

Large brush opening, where two or more consecutive stations occurred in brush areas having a diameter in excess of 160 feet. The maximum diameter of any such area was 1,400 feet. As thus classified, 54 stations occurred in mature forest stands, 50 in pole stands, 63 in sapling stands, 34 in small brush openings, and 57 in large brush openings.

Effects of Aspect

Average water storage on all aspects was greatest on March 1, based upon 3 years of records (Fig. 1). Average water storage was greatest on north aspects, the maximum amount for the 3-year period being 9.58 inches. Maximum amounts averaged 0.35 inch less on east-facing aspects, 0.81 inch less on west-facing slopes, and 2.47 inches less on slopes facing south.

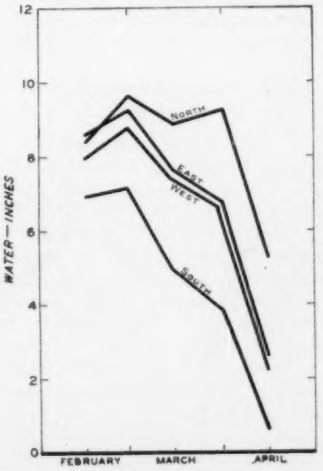


FIG. 1.—Average water content of snow pack on four slope aspects of ponderosa pine lands near Idaho City, Idaho, 1935-37.

By April 15 of each year snow melt was well under way on north exposures and nearly completed on the other aspects. On the average, 5.32 inches of water still remained in the snow pack on north slopes. This exceeded the amount of water retained on east slopes by 2.65 inches, on west slopes by 3.03 inches, and on south slopes by 4.64 inches. During the March 1-April 15 portion of the snow melt period, north slopes lost 2.30 inches less water than east slopes, 2.22 inches less than west slopes, and 2.17 inches less than south slopes.

North slopes were thus more effective than the others for accumulating snow during the winter period and retaining it during the spring. These differences are believed to be attributable to slower melting in the early winter and spring on steep north slopes where the sun's rays strike more obliquely and where topographic shading is more prevalent. In Colorado, Wilm and Collet[2] found that in lodgepole pine forests ranging in elevation from 9,000 to over 11,000 feet, differences in exposure to the sun had no significant influence on the depths of snow built up during the winter accumulation period, but did effect differences in melting rates later in the spring. The lack of influence on early winter accumulation found in the Colorado study is probably attributable to little, if any, early winter melting, even on exposed sites, because of the low temperatures that prevail at such high altitudes.

[1] Connaughton, C. A. The accumulation and rate of melting of snow as influenced by vegetation. Jour. Forestry 33: 564-569. 1935.

[2] Wilm, H. G. and M. H. Collet. The influence of lodgepole pine forest on storage and melting of snow. Trans. Amer. Geophys. Union 21:505-508, 1940.

Effects of Cover

Average water storage in the snow pack was greatest on March 1 under all but two conditions of cover. These were large and small brush openings on north aspects, where maximum depths occurred on April 1. By contrast, in large brush openings on south slopes, the maximum occurred on February 15 (Fig. 2).

The greatest depths of water occurred in sapling stands and in small brush openings on all but north slopes. On the latter slopes, the greatest depth occurred in large brush openings.

The smallest maximum depth occurred in large brush openings on south slopes. Maximum depth was also less than average in large brush openings on west and east aspects, in pole stands on south, west, and north aspects, and in mature stands on north, east, and west aspects.

The relatively low accumulation of snow in the mature and pole timber stands is probably due to greater interception losses by the deeper and more widespread limb and needle canopy that characterizes those stands as compared to the more shallow and less extensive crowns of the sapling and brush stands.

The relatively higher snow accumulation in large brush openings on north slopes as compared to east, west, and south slopes is evidently due to slower melting and less evaporation on north slopes during the early winter. Slower melting on north slopes may be caused by longer and larger shadows cast by trees, brush, and topography during the early winter when the sun is relatively far south. Early winter melting was most rapid in large brush openings on south aspects. Here, apparently, the shorter winter shadows were too small to shade more than a small portion of these large openings.

Snow accumulation in small brush openings on north aspects was almost as great as that in large brush openings, again probably reflecting the slower melting rates attending more extensive early winter shading. On the other three aspects snow accumulation in small brush openings was considerably greater than in large brush openings indicating that on these sunnier slopes the shorter shadows were of sufficient length to shade a substantial portion of these smaller openings.

Large and small brush openings and sapling stands on north aspects were the most effective of all cover conditions for retaining snow. Up to April 15, these sites retained more than 60 percent of the maximum accumulation of water. The April 15 water content on these north aspect cover conditions averaged about 7.50 inches as compared to about 3.50 inches in stands of mature and pole size timber having the same aspect.

The proportion of the maximum water content that was retained in the snow pack to April 15 was progressively less under all cover conditions on east, west, and south exposures. On east slopes, the greatest percentages of winter snow accumulation retained on April 15 occurred in sapling stands and mature timber; whereas on west and south slopes, the greatest percentages were retained in sapling stands and small brush openings. The water retained in large brush openings on south slopes was only 1 percent of its maximum as compared to 69 percent on north slopes. By April 15, the advantage held by those cover types that retained the most snow pack water depended more upon the magnitude of

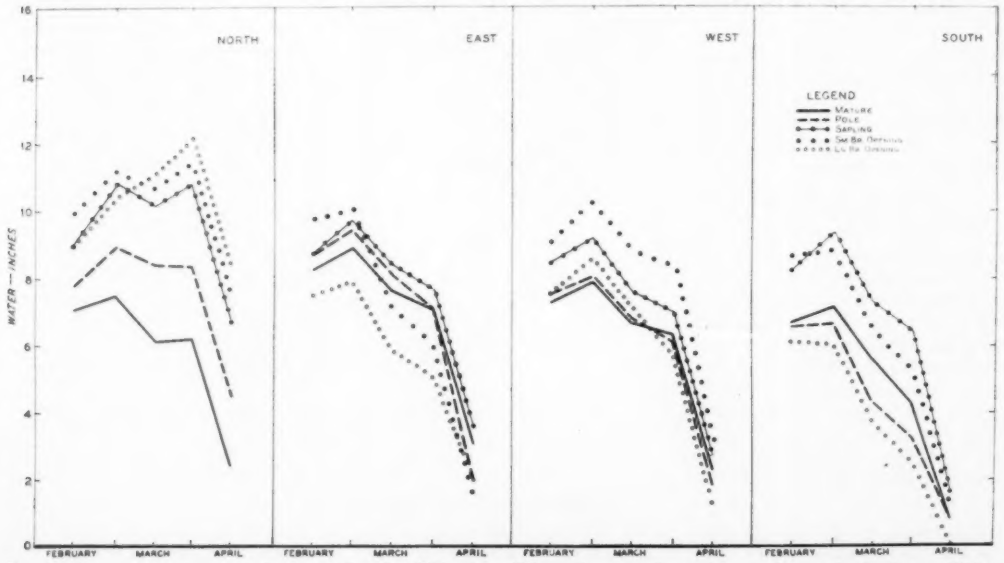


FIG. 2.—Average water content of snow pack under different conditions of cover and aspect on ponderosa pine lands near Idaho City, Idaho, 1935-37.

stored water at the time of maximum depth than upon reduced melting rates. In general, the cover classes that retained the most snow did so because they had accumulated the greatest depths initially.

Lack of measurements from April 15 until the date when the last snow disappeared from each cover condition has made it impossible to attain a complete picture of how cover and aspect influenced the final stages of spring melting rates. However, if the April 1-15 snow melt rates remained constant, snow on north slopes would have disappeared first in mature and pole stands and would have remained 15 to 20 days longer in sapling stands and small and large brush openings. On south slopes, no doubt snow disappeared first from large brush openings and probably remained but a few days longer in the other types of cover.

Management Implications

The effects of aspect and plant cover conditions on snow accumulation and retention observed in this study are in general agreement with results of other comparable studies and observations. They support the commonly held idea that the best opportunity for maximum snow storage and retention in old growth ponderosa pine forest exists on north slopes. On such aspects, it appears that the greatest storage and retention effects can be obtained by creating large openings in the forest stand. Numerous small openings and a high percentage of sapling stand area would be almost as effective. It is also apparent that large openings should be avoided on the sunnier aspects. Here, management practices that favor sapling stands and numerous small openings that are shaded by surrounding trees appear to be most desirable.

The effectiveness of shade cast by topography and different tree classes and the distance over which any influence on snow retention extends into adjoining openings needs further study. Such a study should provide a useful guide to managers of timbered watersheds who wish to harvest ponderosa pine in such a manner as to achieve the greatest accumulations of snow and the longest possible retention of water in the snow pack during the spring runoff period.

An Objective Look at the Vegetation-Stream Flow Relationship

Richard S. Sartz

Forester, Pacific Northwest Forest and Range Experiment Station Portland, Oreg.

JUST HOW MUCH effect vegetation has on stream flow is one of the most controversial problems with which foresters have to deal. Reams have been written about both sides of this highly complex subject; much excellent research has been done. Many of these studies have clearly demonstrated significant effects, but others have failed to do so. As a result of all this, for the novice watershed manager, the air is still clouded with uncertainties. For his information, this paper offers an impartial analysis of the more important factors involved in the precipitation - vegetation - soils - stream flow relationship. It discusses first the separate ways in which vegetation might affect stream flow, and then how each of these may be influenced by the many other variables involved. Such an analysis shows how the effects of vegetation may vary widely under different conditions; it is hoped that it may also give watershed managers some advance knowledge of the effects of timber cutting or other vegetation removal, and of cover restoration on stream flow in their areas. The paper deals only with the effects of vegetation and its removal on quantity of stream flow. It does not consider the part that vegetation plays in preventing erosion. Neither does it consider the effects on stream flow of such land uses as cultivation, grazing, and logging road construction which have other effects than that of cover depletion.

How Vegetation Might Affect Stream Flow

Interception, evaporation, and insulation — Vegetation intercepts rain and snow, most of which is detained for just a short period of time; it then falls from the leaves or twigs, or trickles down the stems and trunks to the ground. But a certain amount is returned to the atmosphere by evaporation before it reaches the ground, and thus is lost from stream flow. A tree or shrub canopy also insulates snow on the ground against the sun's rays, thereby retarding melt. Lengthening the period of melt causes lower peaks at the height of the snow-melt period and allows more water to go into deep seepage, which sustains streams during periods of low precipitation.

Infiltration and storage — Through addition of organic matter and the resulting activity of soil organisms and through protection of the ground from intense sunlight and beating rains, good vegetative cover builds up a loose, porous surface soil. Such soils admit rainfall of high intensities and also hold greater quantities in temporary storage than more compact soils; they are also less susceptible to the formation of impermeable frost. Vegetation builds up litter and humus layers which further protect the soil, reduce evaporation, absorb water, and slow down surface runoff when soil storage capacities have been exhausted. These conditions, which promote maximum infiltration of precipitation, are built up over a long period of occupancy by vegetation. Removal of the vegetation may or may not nullify these beneficial effects, depending on other factors which will be discussed later. The formation of channels through the lower soil horizons by plant roots may also have an effect

on the amount of water that can pass through the soil horizons in a given time.

Transpiration — The roots of plants take up water from the soil and return it to the atmosphere by transpiration through the leaves and stems. Plants not only use gravitational water that ultimately would become available for stream flow, but also create soil moisture deficits by removing water held in the soil against the pull of gravity. Those deficits must be satisfied before water percolating through the soil can again become available for stream flow.

Vegetation Effects Under Different Conditions

Interception, Evaporation, and Insulation

Kind of vegetation—The amount of precipitation that can be intercepted and lost through evaporation depends, aside from precipitation factors, on the surface area of foliage and stems that will detain precipitation. In general, the greater the leaf area of a plant, the more rain or snow it will intercept; however, the branching habit may affect the amount detained. Thus, large trees can intercept more than shrubs, and shrubs more than grass or other low vegetation; but in any of these groups the amount will vary with species, with density of the stand and with age, where age affects the leaf density of the individuals. The presence of understory vegetation beneath a forest canopy would be an additional factor. In the dormant season plants with persistent foliage can intercept much more than those that shed their leaves. Likewise, the insulating effects of deciduous species are of less significance.

As examples of just how much of the annual precipitation might be lost through interception, Wilm and Dunford (*8*) found in Colorado that a mature lodgepole pine forest intercepted from 32 to 35 percent as measured by net precipitation on the ground; Rowe (*5*), in studies of chaparral in California, reported that 5.2 percent was lost. These results are not comparable, of course, because of wide differences in vegetation, precipitation, and other factors. It should also be emphasized that differences in net precipitation due to interception do not necessarily reflect ultimate differences in stream flow.

Precipitation and other climatic factors—The amounts that can be intercepted during a given storm will vary with the quantity of precipitation that falls. In light falls, the amount intercepted may approach 100 percent, but as the precipitation continues beyond the interceptive capacity of the vegetation, the percent detained becomes progressively smaller. This means that for single storms of long duration or for shorter storms with high intensities, the effect of interception on stream flow would be small. On the other hand, when the same amount of rain or snow falls intermittently in smaller storms, the accumulated effect may be appreciable. In Colorado, where summer rainfall ranged from 3 to 10 inches occurring as gentle, intermittent rains averaging about 0.25 inches, Wilm and Dunford (*8*) found that the net rainfall on a heavily cut, lodgepole pine area was 35 percent more than under an uncut, mature stand. (The residual stand averaged 147 trees per acre over 3.5 inches in diameter, the uncut stand, 382 trees.) But in this case, through studies of autumn soil moisture deficits from evaporation and transpiration in cut and uncut stands, they concluded that all of the summer rainfall was lost by evaporation; therefore no immediate effect on stream flow was attributed to summer interception. Their studies of winter snow interception showed that 26 percent more reached the ground on the cut area than on the uncut; of spring precipitation, most of which was snow, 32 percent more. However, increased evaporation—mostly during the spring period—from the cutover area was estimated to account for almost one third of the total gain from both winter and spring precipitation. Thus, rates of evaporation can be an important factor in determining the ultimate effect of interception on stream flow. Where conditions for differential evaporation are extremely favorable, as on warm, dry, southerly slopes, the differences in net precipitation due to interception may even be cancelled out.

Soil factors—Although soil factors obviously do not affect the amount of precipitation that can be intercepted, the effect that interception can have on stream flow will vary with the amount of storage provided by the soil mantle. To illustrate this, let us assume that reduced interception resulting from logging has increased the amount of rainfall reaching the ground during a time when moisture deficits occur in the soil. Where the soil is deep enough, all of the increase may go to replenish the moisture deficit; but if the soil mantle is so shallow that it limits the transpiration draft, the increase may bring the soil above field capacity. The result is some addition to the ground water supply and hence to stream flow.

Topographic factors — Topography affects interception, evaporation, and insulation indirectly by its influence on the vegetation. But there are direct effects as well. Aspect and degree of slope have a direct bearing on the rates of snow melt and evaporation. Where these things are an important part of the hydrologic picture, steep south and southwest exposures would be more sensitive to cover removal than others.

Infiltration and Storage

Kind of vegetation — Little is actually known about relative infiltration rates under different types of natural vegetation, mainly because different types are rarely found on the same soil conditions. Rates probably differ somewhat with the kind of vegetation, due to differences in root systems and in the organic matter content maintained in the soil; but in general, the important factor is the density of the protective cover. Where the vegetation affords little soil protection, clogging of the soil pores and reduced infiltration capacity may result. Infiltration studies from all over the country have shown that the highest rates

are found where maximum soil protection is provided, either by litter or by low-growing plant cover. Exceptions to this general statement have been found, however. The Rocky Mountain Forest and Range Experiment Station reported higher runoff rates from bluegrass than from other grass types having less density (*4*). One explanation might be that the dense mat formed by the bluegrass acted like a thatch roof, diverting the water before it could reach the soil.

Water storage in the soil is primarily a function of the soil itself. However, favorable soil structure brought about by good cover may increase the storage capacity of the upper horizons; and where climatic conditions favor humus development, certain forest species build up surface accumulations of organic debris which store additional water. Studies in the Northeast (*6*) indicate that deeper humus layers develop under dense stands than under open ones, where sunlight causes more rapid oxidation of the organic matter; and that depth also increases with stand age, up to a point where equilibrium is reached. On the other hand, the litter of some species, such as West Coast Douglas-fir, often breaks down and leaches into the soil too quickly for surface organic layers to accumulate, however old or dense the stand.

Precipitation and climatic factors—How much effect cover removal will have on infiltration rate depends on the intensity with which water is applied to the soil. Melting snow or gentle rain is not likely to cause reduced infiltration. Therefore, modifying the cover would not be expected to change the infiltration rate where these conditions prevail. But where high-intensity rains occur, exposure of the soil may mean drastic reductions in infiltration rate, with increased runoff and real changes in stream flow resulting. This was shown by Rowe's study in California (*5*) where annual burning of woodland chaparral caused a decrease of more than 95 percent in the average infiltration capacity on one plot. During the maximum storm of the nine-year period of study, most of the rainfall left this plot as surface runoff, while on the undisturbed plots no measurable amounts were produced.

A second factor would be the incidence of soil freezing. Conditions that lower the infiltration rate also render the soil more susceptible to impermeable frost, which further drastically reduces infiltration. Another factor associated with climate is the protection of the soil afforded by ground cover following removal of the major vegetation. In humid regions like the coastal Pacific Northwest, a dense ground or brush cover may become established soon after logging, thereby preventing impairment of the former infiltration rate to any marked degree.

Soil factors—The capacity of any soil to take in water is fundamentally a function of the soil properties. It depends primarily on the size and arrangement of the soil particles. Heavy soils, such as clay, have inherently low percolation[1] rates, while at the other extreme, sands and gravels have high rates. But good cover will promote higher percolation rates than would be found on the same soil without cover. This effect is most pronounced at the surface where biotic activity is greatest, and diminishes with depth into the profile. This has been shown by at least one study (*7*) and supported by other observations. Once the zone of plant influence has been traversed by percolating water, further infiltration is limited by the inherent rate of the underlying soil. However, puddling of the surface soil may so reduce the percolation rate at that point that it will limit the rate of movement into the rest of the profile. When this reduced rate is exceeded by rainfall intensities, immediate surface runoff will take place.

The extent to which percolation values are impaired by exposure of the soil depends on the type of soil as well as the precipitation factors already mentioned. Soils having easily dislodged fine fractions—generally the heavier textures—are most readily puddled, while coarse sands and gravels may be little affected. Infiltration rate may also be materially reduced by frost in the soil. Loose, porous surface soils are less susceptible to impermeable frost than heavy, compacted ones. Regardless of the cover condition and its effect on the soil, surface runoff is bound to occur when the capacity of the surface soil to take in water is exceeded by rainfall intensities. When a lower horizon is limiting, subsurface runoff may result.

There are three recognized forms of water stored in the soil. When a soil becomes saturated most of the water occupying the noncapillary pores and channels made by roots and soil organisms drains off by gravity. This is known as gravitational water and the volume occupied by it is called the *detention storage capacity*. It contributes directly to stream flow. The water that is left in the small pores of the soil is called capillary water and its volume is known as *retention storage capacity* or *field capacity*. This is the primary source of water used by plants. Retention storage includes a small amount existing in the form of thin films around the soil particles. This is the hygroscopic water; it can be removed by neither plants nor gravity. Both detention and retention storage are important from a hydrologic standpoint; but of the two, detention storage is of more significance to the vegetation-stream flow relationship because it is more affected by changes in the soil that would result from changes in the vegetation.

Like infiltration, soil storage capacities vary with the texture and structure of the soil and are affected by cover removal in about the same way. In addition to loss of detention storage space through clogging of the soil pores, exposure results in accelerated oxidation of organic matter with an accompanying breakdown of structure and loss of both detention and retention storage. Mor[2] humus lay-

[1] Percolation rate refers to the rate at which water will move past a given point in the soil profile, while infiltration rate refers to the rate at which it will be taken into the soil.

[2] Mor humus is decomposed organic matter, not mixed with the mineral soil.

ers, which have very high retention and detention storage capacities, disappear completely when exposed to the elements for a few years. Loss of this storage and storage reductions in the surface soil are not likely to cause any profound changes in stream regimen, but under certain meteorological circumstances the difference could have a significant effect on flood peaks. This is especially true on shallow soils, for there the storage space attributable to vegetation effects represents a greater percentage of the total profile storage than on deep soils. As the depth of the soil profile increases, this effect becomes relatively smaller.

Topographic factors—Aspect is important because of its influence on local climate, hence on the stability of soil organic matter. Surface runoff opportunity obviously increases with the slope. Thus, the role of litter and humus in surface detention may be an important factor where steep slopes are part of the watershed makeup.

Transpiration

Kind of vegetation — With an unlimited supply of water available, some plants must certainly have the inherent ability to transpire more water than others. Except for stream-bordering and swamp vegetation, however, this variation is not important because transpiration rates are usually limited by the soil moisture available soon after precipitation has stopped. From studies made in Utah (*1*), Croft concluded that the amount of water that can be transpired by plants depends on the depth of root penetration; that the deeper the root penetration, the more water plants will use.

Precipitation and other climatic factors — The transpiration draft by vegetation has an immediate effect on stream flow during the growing season when the plants are using water. It also creates soil moisture deficits that may carry over into the dormant season. After the initial replenishment of these deficits, transpiration ceases to be an important factor in the vegetation-stream flow relationship for the remainder of the dormant season.

The immediate effect of transpiration is disposition of rain falling during the growing season that otherwise would become available to the streams. It varies with the amount and distribution of precipitation. Where only small amounts of rain fall intermittently, transpiration has little or no immediate effect because interception, evaporation, and transpiration dispose of all the water; and a decrease in transpiration losses through treatment would be offset by increased evaporation. As evaporation and transpiration rates are very low during rainfall periods, the effect that transpiration might have on stream flow by disposing of soil moisture from prolonged rains will decrease as the amount of continuous rain increases. Once the deficits are satisfied, little water is utilized by the transpiration process until the humidity falls again. But where enough rain, evenly distributed throughout the growing season, falls to add water to the streams, the effect of the vegetation draft can be appreciable. This was shown by Hoover (*3*), in a study made at the Coweeta Hydrologic Laboratory in North Carolina where the average annual precipitation of 77 inches is well distributed. Cutting all major vegetation (an oak-hickory overstory with a rhododendron-mountain laurel understory) on a 33-acre watershed, increased stream flow by 100 percent from August through October the first year after cutting. The increase for the whole year was 65 percent. None of this was due to surface runoff, for all vegetation was left on the ground after cutting and the forest floor was not disturbed; thus infiltration even after treatment was not exceeded by precipitation rates.

Soil factors—The amount of water that is lost through transpiration depends on two factors associated with the soil. One of these is the depth of the soil mantle. The storage opportunity of any soil profile is primarily limited by its depth. The depth that plant roots penetrate may also be limited by the soil depth. Deeper root penetration means that more water is used because the root system has access to a larger reservoir. This has an indirect effect on stream flow: during the period when soil moisture deficits are being replenished, more of the precipitation is utilized in satisfying these deficits, and less contributes to stream flow.

The other factor is whether or not the plant roots extend into the water table. Where this condition exists, the transpiration draft during the growing season can greatly influence the volume of flow. The amount, of course, depends on what proportion of the watershed is affected. How much effect riparian vegetation might have on stream discharge was well demonstrated by another study at Coweeta (*2*). On a 22-acre watershed all woody vegetation growing at elevations less than 15 feet above the stream bed was cut, lopped, and scattered. The area cut was a strip 1600 feet long, with a varying width of 50 to 250 feet. It represented 12 percent of the watershed area. This treatment resulted in daily stream flow increases of 3.8 to 19.0 percent, or an average increase of 12 percent for a ten-day period. The authors concluded that "Important gains in water yield during the growing season in the southern Appalachian region may be realized with relatively little effort by eliminating the transpiration draft of stream-bank vegetation."

Discussion

Watershed management people need to know the effects of vegetation on stream flow because they must know how management measures that change the vegetation will alter these effects. Further, they need to know under what conditions the effects will be altered and when they will remain unchanged. As this paper suggests the quantitative effects of vegetation on stream discharge vary widely, depending on how many of the separate factors are acting and on the extent to which they are affected by the controlling variables. Under some conditions adjustments of the cover do not greatly affect the volume of stream flow, but un-

der others pronounced changes result. Quantitatively assessing the summation of the individual components is a much more complex problem which must be worked out separately for each set of conditions. To do so, the watershed manager must have an intimate knowledge of those factors of vegetation, precipitation, and soils that affect their interrelationship in his area.

One common misconception about the role of vegetation in the hydrologic cycle is that restoration or preservation of watershed cover is a cure-all for water ills; that it can increase low flows and at the same time prevent damaging floods. This is only partly true. While good plant cover promotes maximum infiltration and storage, thereby preventing or reducing surface runoff, it also dissipates some of the precipitation through interception and transpiration. When these losses can be reduced without loss of infiltration, low flows will be increased. The important thing is to know what reduction in cover can be made without impairing infiltration and causing erosion.

Literature Cited

1. CROFT, A. R. 1950. A water cost of runoff control. Jour. Soil and Water Conservation. Vol. 5 (1):13-15.
2. DUNFORD, EARL G. and P. W. FLETCHER. 1947. Effect of removal of stream-bank vegetation upon water yield. Trans. Amer. Geophys. Union 28(1):105-110.
3. HOOVER, M. D. 1944. Effect of removal of forest vegetation upon water yields. Trans. Amer. Geophys. Union, Part IV:969-977.
4. ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION. 1951. Annual Report for 1950. Pp. 19-21.
5. ROWE, P. B. 1947. Influence of woodland chaparral on water and soil in central California. Bulletin published by the State of California under a cooperative agreement with the California Forest and Range Experiment Station.
6. SARTZ, RICHARD S. and WILLIAM D. HUTTINGER. 1950. Some factors affecting humus development in the Northeast. Jour. Forestry 48(5):341-344.
7. TRIMBLE, GEORGE R., JR., CHARLES E. HALE, and H. SPENCER POTTER. 1951. Effect of soil and cover conditions on soil-water relationships. Northeast Forest Exp. Sta. Station Paper No. 39.
8. WILM, H. G. and E. G. DUNFORD. 1948. Effect of timber cutting on water available for stream flow from a lodgepole pine forest. U. S. Dept. of Agric. Technical Bulletin No. 968.

Full Utilization and Available Markets the Key to Intensive Forestry in the Pacific Northwest[1]

Clyde S. Martin

Weyerhaeuser Timber Company, Tacoma, Wash.

IF ONE REVIEWS realistically the development of a sound forest economy in other countries and in other forest regions of the United States, a common pattern appears.

At first the forests were an obstacle to the settlement and development of the country. They were cleared and burned to make way for farms and towns. Soon, however, the choice products of the forest became valuable for early exports and necessary for the building of state and nation. Wood is one of the necessities of human existence. It provides shelter, warmth, transportation by land and water, and furnishes many of the comforts of civilization. Above all, during the pioneering and development stages of a forested country, wood is plentiful, cheap, and requires little processing before it can be used.

Any resource which is cheap, plentiful, and in large demand is wastefully used. The public seldom worries about the future as long as the present is reasonably comfortable and prosperous. So inevitably, the forest and its products gradually become less plentiful and more costly. Devastating floods and forest fires draw public attention to impending scarcities in a resource which has become a necessity to human welfare.

At this point farseeing men begin drawing public attention to the inevitable results of a lack of wood products and of adequate forest cover on the watersheds. Unfortunately, the public must become concerned and even alarmed before it can be aroused to needed action to protect a future several generations away. So, the country passes into a period of crusading conservation which highlights catastrophes and points with alarm to local and regional shortages and economic difficulties. This also is a necessary stage in the evolution of a stable and prosperous forest economy. It results in the passage of needed legislation protecting the forest resource from heedless destruction and eventually providing some assurance of a future supply of forest products.

During the growth of a country the forest economy is largely dependent on the production of primary forest products; logs, poles and piling, railroad ties, posts, fuel, naval stores, and lumber. The early lumber industry was necessarily wasteful. Its products were cheap. Consumers would only use high grade material. The supply of stumpage was ample and readily available. It could be purchased much more cheaply than it could be grown and the risks of carrying a crop of timber to economic maturity were high. Forest fires and destructive insect epidemics were not yet under measurable control.

In this country such conditions prevailed until the mid-thirties of this century. It is true that a few forward-looking individuals and organizations had seen the future clearly and were preparing to meet it. Federal foresters were protecting, conserving, and organizing the national forests to fulfill their destiny as a backlog to ease the transition from a liquidating to a renewable forest resource. A few of the states had preserved and protected their forests, but by and large, except for isolated instances and experimental tracts, there was little intensive forestry practiced in the United States, even by the federal government. No sound economic basis for permanent scien-

[1]Paper presented at a meeting of the Division of Forest Products, Society of American Foresters, Washington, D. C., December 15, 1950.

tific forest management had yet been reached. But, during the slow recovery from the great depression, followed by the shock of World War II and its aftermath, the rapid development of integrated industry, conditions changed, and we now find a sound economic basis for the practice of forestry in this country.

In the Pacific Northwest, as in other regions, the practice of forestry has closely followed the development of economic trends.

Again, until the mid-thirties, harvesting the forest crop in the West with its large timber, exceedingly rough topography, and long hauls, was primarily a high speed, high powered operation using heavy machinery and depending largely on rail transportation. The use of this type of machinery was destructive. Large investments in logging railroads with short-lived ties and trestles encouraged the clear cutting of large contiguous areas. Broadcast slash burning followed by accidental fires destroyed seed areas and advance regeneration. Only the natural productivity of the land and increasingly effective forest fire protection kept timber growing.

Then came the development of the crawler tractor, the logging truck, the bulldozer, and other effective mobile earth moving machinery. It became feasible to build more roads and log by trucks. Small bodies of timber could be logged economically and much hitherto inaccessible timber became readily accessible.

The National Recovery Act placed squarely upon industry the responsibility of assuring a future crop of timber, and the western forest industries fully accepted this responsibility and organized to undertake it. Protection from fire, largely mechanized and dealing with smaller areas of high hazard, became more effective. More attention was given to protection from forest insects and diseases.

This was the background for better forest management in the Northwest.

Then came World War II with its huge demands for wood products. The pulp and paper industry began to expand. Sulphate mills and fiber board plants were established. The results of years of forest products research began to be fruitful as practicable processes were worked out for the manufacture of many products from hitherto unutilized material. Responding to higher prices and an almost unlimited demand, most of the available privately owned stumpage was bought up by operating companies. Stumpage increased in value and no longer could it be readily purchased for less than the cost of growing it. The more stable elements of the forest industries became concerned about the future supply of raw material for their plants and began to acquire forest lands on a large scale and to prepare those lands for the efficient production of forest crops.

Economics Dictate Better Forestry

By 1945 the basis of a sound forestry economy had been reached. Since the end of the war, progress in forest management based upon ample markets and more complete utilization of the forest crop has been rapid. The boom in home and industrial construction has accelerated this progress and now the heavy demands for national defense are maintaining it.

Let us, therefore, take a look at the present status of forest utilization in the Pacific Northwest together with its impact on the more intensive management of our forest lands both public and private.

The first notable step toward more complete utilization of wood from the forest was the development of a number of types of hydraulic barkers for logs and cordwood going into the pulp mills. This sort of bark removal saved from 15 to 20 percent more of the wood fiber for chips. With this development came more efficient chippers, some of which handled a 40-inch diameter, 40-foot log as easily as a stick of cordwood.

This was followed by a really remarkable increase in salvage logging—the relogging of areas once logged-over or burned. Logs, chunks, and defective and damaged trees were taken, sometimes to supply adjacent small or portable sawmills, but largely to supplement the material going into larger and better integrated groups of processing plants. The Tillamook burns of 1933-39 became a beehive of activity. Reliable estimates have been made that more timber will eventually be logged from this heavily burned area of nearly 300,000 acres than appeared on the original cruise of the area as green timber. In any case, hundreds of millions of board feet of salvage logs have been removed annually from areas once written off as liquidated. Much of this material was not a drain on the estimated forest resource as it had already been written off as logged or burned.

Following this, about 1947-48, came the development of prelogging—the removal of small understory trees before the heavy mature and overmature trees were felled. Most of these understory trees had previously been shattered and broken during the main logging operation. Where such prelogging is feasible, an average cut of about 8,000 board feet per acre is taken. Most of such material, coming from clean boled, slow growing, semi-suppressed trees, makes excellent pulping material with a measurably higher yield of pulp per thousand board feet than can be obtained from either harvest trees or thinnings.

Also, as a result of the more widespread use of hydraulic and pressure barkers, more chips from slabs and mill waste became available for sulphate pulping. This was cheap pulping material and was available in huge quantities. The barked logs could also be more efficiently utilized in the sawmill, as the sawyer could see surface defects and unevenness in the log surface. The sawmills were largely freed from bark particles and were easier to keep clean, reducing the fire risk.

With a supply of clean bark available in large quantities, earlier experiments in its use for marketable products became fruitful. A beginning has been made in the commercial manufacture of bark products and the future utilization

of Douglas-fir bark appears promising. Some bark products are already being used as fine powders, glue and cement extenders, soil conditioners, and insulating material.

Another logical and very important step in the more complete utilization of forest growth in the Pacific Northwest is just getting under way and is still in the experimental stages: to use the growth of fir and hemlock forests which is lost through suppression and overcrowding during the merchantable stages of growth before the crop is ready for final harvest. This loss amounts to as much as 500 board feet per acre annually between the ages of 30 and 60 years. If this could be fully utilized through thinning and intermediate cuttings, it would add another 15,000 board feet yield on each acre so treated. The early experiments along this line are very promising. Yields of from 20 to 30 cords per acre have been obtained from 50- to 60-year old stands at a competitive cost, and the pulp mills like this material if cost can be kept in line. The limitations on this type of cutting at present are the availability of markets and the necessity of making such thinnings on favorably located, easily accessible sites. Methods of marking and of handling this part of the forest crop are being rapidly developed. It may eventually be the source of material for a sizable expansion of the pulp and paper industries in the region.

Further Development Ahead

In enumerating these more notable elements of closer forest utilization, we must not overlook the many other uses of forest products which are steadily developing and which will eventually become sizable outlets for by-product materials—soft boards of various kinds, some pressed from bark and sawdust with various binders.

Other possibilities include: The greater use of subsidiary species; the expanded use of pressed fuel blocks and wood flour products; the remanufacture of veneer core blocks and chipping of veneer trimmings; utilization of wood chips for insulating and packing material and for conditioning soil; more fabrication of trusses, timber, and boards from small pieces of wood; the patching of defects in lumber and plywood; the use of plastic surfaces on plywood; the reclamation of values from pulping liquors; the manufacture of alcohol, yeast, and molasses from chips; the chemical reduction of old stumps for naval stores and other products; and the rapidly expanding markets for minor forest products such as Christmas trees, ferns, and forest shrubbery.

Many of these processes are being developed by small independent manufacturers often located in the smaller towns and providing subsidiary markets for primary forest products and utilizing materials which were formerly used as fuel or wasted. There also are several examples of tree farms of various sizes, composed entirely of cutover, burned over, and second growth lands, managed by foresters, which are not only meeting carrying costs and current overhead expenses but are returning a modest profit on their operation.

The causes of this favorable forestry situation in the Pacific Northwest are many. Most of them are purely economic—available markets at good prices. But, fundamentally, they are the result of years of research by the Forest Products Laboratory at Madison, Wis.; by private companies and associations; and last but far from least the work on products research accomplished by the University of Washington, College of Forestry, and the Oregon State Forest Products Laboratory, the latter partially financed by a small severance tax on forest products cut from Oregon forests. During the past few years the Washington State Institute of Forest Products has been doing notable work in making an inventory of existing supplies of forest by-products and utilizable waste. Current developments are made public periodically by both Washington and Oregon State institutions not only as booklets but in releases to the press and to periodicals. This information, which stimulates industrial development, is not filed away in scientific reports. It is made readily available to the general public.

These developments have created a marked change in the forestry picture in the Northwest. A conservative estimate would show an increase of at least 25 percent in the material now being removed and used from each acre of forest land harvested as compared with 1940 utilization. This is equivalent to increasing the utilizable growth potential of the land by that much. Such utilization will prolong the period during which the overmature and mature forests are supplying the bulk of consumer demands. This in turn allows more time for growing a second crop of timber.

The conclusions to be drawn from this generalized forestry picture of the Pacific Northwest are:

1. That this region has reached a favorable economic basis for the establishment of a permanent forest economy based upon higher values and expanding markets.
2. That the gradual evolution tending toward more complete utilization of all of the products grown on forest lands should continue.
3. That these facts are now recognized by the stable elements of the forest products industries and by progressive forest landowners who are engaged in changing their practices to conform with the new outlook.
4. That if governments, both local and national, will continue to work with industry on a constructive, co-operative basis in developing more complete utilization of all forest products, the Pacific Northwest can look forward to a future largely based on a stable and prosperous forest economy.

Yield and Quality of Jack Pine Pulpwood Produced on Different Types of Sandy Soils in Wisconsin[1]

S. A. Wilde, Benson H. Paul, and Peitsa Mikola[2]

Professor of soils, University of Wisconsin, chief, Division of Silvicultural Relations, U. S. Forest Products Laboratory, and visiting scholar, Forest Research Institute of Finland, respectively.

THE PURPOSE of this study was to evaluate the capacity of different types of sandy soils for quantitative and qualitative production of jack pine pulpwood. The initial phase of investigation dealt with the effect of soil on the rate of stand growth. The second phase was concerned with the physical and chemical properties of wood produced on different sites; such properties to a certain degree determine the yield of usable pulp and the efficiency of the paper manufacturing process.

In accordance with previous experiences (*9, 10*) an attempt was made to narrow down natural variations in stand composition, soil fertility, and especially light conditions. The age of the stands studied was limited to the range of 35 to 39 years. With one exception (moss peat), stand density on sample plots varied between 80 percent and 90 percent of full stocking. Observations were confined to soil types developed from the same surface geological formation — sandy glacial outwash.

The desire to avoid geological complications was not the only reason for the choice of outwash sands. These soils are the principal habitat of Wisconsin jack pine. Their level topography, freedom from stones, and accessibility greatly facilitate the tasks of silvicultural management, and their modest price encourages acquisition by private forestry enterprise.

In spite of the superficial uniformity of level or slightly undulating outwash sands, the action of atmospheric and biological factors has differentiated these deposits into a number of soil types which vary considerably in their ability to grow forest crops (*11*). Five types, covering a wide range of soil productive capacity for jack pine stands, were included in this study. Their brief description follows.

1. *Aeolian sands* (windblown sands) are dune-like portions of glacial outwash reworked by wind action. These humus-deficient deposits are about the poorest forest soils in the state, and are usually referred to as "sand barrens." They are marked by ground cover of reindeer moss (*Cladonia* spp.) and xerophytic grasses. With the exception of jack pine and scrub oak, forest trees and even shrubs do not find sustenance on these inhospitable grounds.

2. *Melanized sands* (Humus-stained sands with porous subsoils) are characterized by a 4- to 6-inch dark colored surface layer consisting of an intimate mixture of mineral soil and humus. The rest of the profile is formed by a coarse sand of yellowish-brown color. The accumulation of humus in the surface layer of these "black top sands" is largely due to coarse texture and droughtiness of these soils, that is, conditions responsible for the open nature of the original forest and the occurrence of thick grass cover. The ground vegetation of these soils is remarkable in its uniformity throughout the state and, besides xerophytic grasses, consists of bearberry (*Arctostaphylos uva-ursi*), New Jersey tea (*Ceanothus americana*), and low bush blueberry (*Vaccinium angustifolium*). A sporadic understory of dwarfed hazelnut (*Corylus americana*) is another striking characteristic.

3. *Podzolic sands* (leached sands with a dense subsoil) are distinguished by a pronounced accumulation of raw organic remains attaining a thickness of about 2 inches and ashy-gray leached layer underlain by a compacted reddish-brown zone. The leaching and redeposition of fine colloidal particles in this type is effected by percolating water charged with organic acids and is referred to as "podzolization." In a mild form this process has a highly beneficial effect on tree growth since the impregnation of the lower soil layers by clay and humate suspensions greatly increases the water-holding capacity of the soil. The rich ground cover consists largely of raw humus plants, among which the Canada blueberry (*Vaccinium canadense*), Canada mayflower (*Maianthemum canadense*), and wintergreen (*Gaultheria procumbens*) are particularly prominent.

4. *Gley-podzolic sands* (leached sands influenced by the ground water table) have a morphology essentially similar to the previous type except that at a depth of from 3½ to 5 feet the soil is saturated with water. The presence of ground water leads to the development of a "gley" horizon, i.e. a deoxidized zone mottled with iron compounds in different stages of reduction. Canada blueberry (*Vaccinium canadense*), bunchberry (*Cornus canadensis*) and trailing dewberry (*Rubus* spp.) are the conspicuous members of the ground cover.

5. *Moss peat* (shallow peat over sand) is formed by a 4- to 6-inch layer of living and dead moss material resting on severely leached sand which at the depth of 1 foot is underlain by a gley horizon. The ground cover consists of bog moss (*Sphagnum* spp.), haircap moss (*Polytrichum* spp.), Laborador tea (*Ledum groenlandicum*) and other muskeg plants. This type of soil supports jack pine only in very rare instances and was included in this study to detect the extreme effect of stagnant ground water.

As a rule, sample plots were located on areas covered by previous detailed soil surveys. Particular attention was given to the characteristic features of the ground cover vegetation which were determined by the use of a chain transect method (*8*). As far as possible, the data on timber volume and growth rate, determined on sample plots, were checked against cruising records. The entire study included 47 fifth-acre plots located in Adams, Wood, Washburn, Douglas, Bayfield, Vilas, Oneida, and Marinette Counties. On 24 of these sample plots the soils and growth studies were supplemented by investigation of wood properties. The distribution of sample plots in relation to soil types is given in the following outline:

Soil type	Total number of plots used in the study	Number of plots from which wood samples were collected
Aeolian sand	8	4
Melanized sand	14	6
Podzolic sand	15	9
Gley-podzolic sand	9	4
Moss peat	1	1

[1]Contribution from the Soils Department, University of Wisconsin, in cooperation with the U. S. Forest Products Laboratory and the Institute of Paper Chemistry, Appleton, Wis. The study was supported by the Nekoosa-Edwards Paper Company and the Wisconsin Conservation Department.

[2]The writers owe a debt of gratitude to Dr. T. A. Pascoe and Messrs. F. G. Kilp and R. C. Dosen of the Nekoosa-Edwards Paper Company and to Dr. H. F. Lewis of the Institute of Paper Chemistry for their time and efforts devoted to this project. Credit is due to G. K. Voigt, E. C. Steinbrenner, P. A. Roberts, R. Wittenkamp, D. R. Luebke, John Trach, and S. F. Peterson, assistants in soils, who were employed in field and laboratory investigations.

The investigations of soils were conducted by excavation of a profile to the depth of 5 feet or to the ground water level in each sample plot. The genetic type of soil, textural composition, and resistance to air passage of the subsoil at an approximate depth of 18 inches were determined in the field. Duplicate soil samples from the 7-inch surface layer were collected by means of a sampling tube for laboratory analyses. The A.O.A.C. (*1*) and Wisconsin Soils Department (*6*) methods were used in determining fertility factors with the exception of air permeability; the latter property was measured by a sphygmomanometric unit with an aneroid type of recorder (*7*). The results of analyses showed only slight deviations, and the average values are given in Table 1.

The age, average diameter, and the current increment for the last 10 years were determined by the usual methods. The determination of heights was confined to dominant trees whose number varied between 10 and 15 per sample plot. The establishment of site index was made on the basis of yield tables for the Lake States region (*2*). The yields were estimated, excluding bark, on the basis of gross volume of all trees present on sample plots to a top diameter of 2 inches inside bark. On 24 plots laid out for investigation of wood quality, the form factor was also determined as a ratio between diameter at 25 feet and diameter at 5 feet.

Because of sharp differences in the physical make-up and fertility levels of the selected soils, mensuration studies revealed a clear picture of the soil-forest growth relationship. The variation between the yields of different plots located on the same soil type did not exceed 10 percent. The average results are summarized in Table 2.

A comparison of growth data with the results of soil analyses shows that deficiency of absorbing colloids, lack of nutrients, and impeded drainage are the factors which place aeolian sands and moss peat in the class of lands which have questionable value for timber production on a commercial basis.

TABLE 1.—AVERAGE STATE OF FERTILITY FACTORS IN SOILS OF DIFFERENT TYPES (7-INCH SURFACE LAYER) SUPPORTING JACK PINE STANDS IN WISCONSIN

Type of soil and floristic cover	Reaction	Silt and clay	Air permeability of subsoil	Organic matter	Base exchange capacity	Spec. conductance	Total N	Avail. P_2O_5	Avail. K_2O
	pH	*Percent*	*Mm.*	*Percent*	*ME/100 g.*	*mhos 10-5*	*Percent*	*Lbs/A*	*Lbs/A*
Aeolian sands ..... *Cladonia* T.	5.62	4.7	5.2	0.87	1.94	3.6	.017	39.0	45.3
Melanized sands .... *Arctostaphylos-Ceanothus* T.	5.37	9.6	7.5	2.14	4.40	4.3	.056	48.8	70.9
Podzolic sands ..... *Gaultheria-Maianthemum* T.	4.83	10.7	22.7	3.02	5.81	5.1	.078	78.1	163.2
Gley-podzolic sands *Vacc.-Cornus-Rubus* T.	4.70	10.2	33.0	3.27	6.29	4.2	.072	64.5	215.5
Moss peat ..... *Sphagnum-Ledum* T.	4.46	8.5[1]	67.5	17.5	32.4	3.5	.270	12.5	60.0

[1]Substratum.

TABLE 2.—AVERAGE GROWTH DATA OF JACK PINE PULPWOOD ON DIFFERENT SITES

Soil and floristic type	Average age	Average number of trees per acre	Average d.b.h. in.	Average dia. at 25 feet	Form factor	Diameter increment for last 10 years	Average height	Site index	Yield per acre
	Years		*Inches*	*Inches*		*Mm*	*Feet*		*Cords*
Aeolian sands ..... *Cladonia* T.	39.0	510	4.4	2.4	.54	8.8	36.6	45	6.9
Melanized sands .... *Arctostaphylos-Ceanothus* T.	37.6	588	5.6	3.7	.66	11.5	43.6	52	11.2
Podzolic sands ..... *Vaccinium-Gaultheria-Maianthemum* T.	37.3	494	6.4	4.5	.70	13.3	50.0	63	14.2
Gley-podzolic sands *Vaccinium-Cornus-Rubus* T.	38.5	473	6.9	4.8	.70	14.0	52.9	68	16.0
Moss peat ..... *Sphagnum-Ledum* T.	39.0	1,328	4.2	2.3	.55	11.2	36.5	45	9.2

The fact that the measured yields of jack pine stands on all soil types studied fall below the level of most yield tables must be attributed to the post-fire origin of stands which were not regulated by thinnings and show certain irregularity in the spacial distribution of stems. The close correlation between the form factor as determined in this study and site index of stands (Table 2) deserves mention.

In studying wood properties, five co-dominant trees of approximately average diameter were felled on each sample plot. From each sample tree 8-inch sections were removed at a height of 5 feet and 25 feet. Determinations of specific gravity were made for each individual section on oven-dry weight and green volume basis, using the immersion method (standard Forest Products Laboratory procedure). For chemical analyses, equal weights of sawdust from individual samples were thoroughly mixed. The composites were blended and passed through a Wiley mill using a 40-mesh screen. That portion which passed through a 40-mesh but was retained by the 80-mesh screen was taken for analysis. Crude protein was determined by the standard Kjeldahl method (*1*). In determination of alcohol-benzene solubles a test specimen of air dry meal of known moisture content was extracted for 4 to 8 hours. Extractives were determined by removing most of the solvent on a steam bath and drying the residue to a constant weight under vacuum at 60 degrees C. In determining alpha-cellulose, resin-free samples were chlorited for 4 hours at 75-80 degrees C. The chlorite holocellulose was determined by the Technical Association of the Pulp and Paper Industry Method T203m (*5*).

The results of wood analyses were not free of erratic data. Some of these exceeded three times the standard deviation and were rejected. The calculated averages then fell in logical order, justifying certain tentative conclusions.

The mean values, presented in Table 3, show significant differences in the physical as well as chemical composition of wood from the lower and upper parts of the bole. On the average, the wood samples obtained from the 5-foot height analyzed .04 higher specific

TABLE 3.—PHYSICAL AND CHEMICAL PROPERTIES OF JACK PINE WOOD PRODUCED ON DIFFERENT TYPES OF SOILS IN WISCONSIN (AVERAGE RESULTS)

Type of soil and ground vegetation, and average site index	Number or rings per inch	Specific gravity	Crude protein	Alcohol-benzene solubles	Alpha cellulose
Composition of wood 5 feet above ground line					
			Percent	*Percent*	*Percent*
Aeolian sand ..... *Cladonia* T. S.I. 45	17.7	.421	.453	3.3	41.2
Melanized sand ..... *Arctostaphylos-Ceanothus* T. S.I. 52	13.2	.413	.485	3.1	42.7
Podzolic sand ..... *Gaultheria-Maianthemum* T. S.I. 63	11.9	.399	.578	3.0	44.2
Gley-podzolic sand ..... *Vacc.-Cornus-Rubus* T. S.I. 68	10.7	.402	.579	2.9	44.3
Moss peat ..... *Sphagnum-Ledum* T. S.I. 45	19.1	.436	.409	3.1	45.8
Composition of wood 25 feet above ground line					
Aeolian sand ..... *Cladonia* T. S.I. 45	14.7	.384	.585	2.7	40.4
Melanized sand ..... *Arctostaphylos-Ceanothus* T. S.I. 52	10.1	.382	.617	2.4	42.1
Podzolic sand ..... *Gaultheria-Maianthemum* T. S.I. 63	9.7	.369	.573	2.7	42.8
Gley-podzolic sand ..... *Vacc.-Cornus-Rubus* T. S.I. 68	8.6	.376	.586	2.3	41.8
Moss peat ..... *Sphagnum-Ledum* T. S.I. 45	17.7	.361	.523	2.9	41.9

gravity and 2 percent higher content of alpha-cellulose than did wood samples from the 25-foot height. The results also indicate that site conditions exert a marked influence on specific gravity of wood and its content of alpha-cellulose and crude protein. The content of resins and other alcohol-benzene extractibles tends to increase in the older wood and in the wood from poor sites. It is of interest to note that the content of protein is inversely related to specific gravity.

While the data presented in Table 3 outline the dimensional and environmental variation in wood composition, they reveal an incomplete and, in some instances, a distorted picture of the site influences on the yield and quality of pulpwood. The full practical significance of the results can be disclosed only by establishing the actual solid volume and weight of a cord produced on different sites, and hence composed of pulpwood sticks of varying average diameters. The calculation of the solid volume of cords was accomplished by following the standard procedure of the Forest Research Institute of Finland (*3, 4*). The converted values are given in Table 4.

In spite of the general tendency of specific gravity to be lower for fast-grown trees, the weight of a cord of wood produced on fertile soils is higher than that produced on poor sites. In some cases the difference amounts to about 3 percent. Considering the enormous volume of wood passing through the mill, this difference is likely to be of consequence in the manufacture of mechanical pulp. In the case of the Nekoosa-Edwards Pulp and Paper Company, the purchase of pulpwood exclusively from poor sites would result in an annual loss of about $70,000.

The site-wood quality relationship becomes even more pronounced when one takes into account the content of alpha-cellulose. In extreme instances, the actual yield of alpha-cellulose per cord in wood from fertile sites is 8 percent higher than that in wood from poor sites. This may be of decisive importance in the manufacturing of bond or other high grade paper.

Considering production on an acre basis, stands of the approximate age of 40 years on reasonably fertile soils deliver 100 to 150 percent higher weight of wood, as well as alpha-cellulose, in comparison with stands of the same age on infertile soils. Aside from characteristics determined by analysis, small-dimension timber bears many branches, has a high percentage of knots, and increases logging costs per cord when payment is made on a stick basis. Thus, the results point out that procurement of small-dimension wood cannot benefit the general economy of pulp and paper manufacturing. Therefore, the principal means of improving the quality of pulpwood on infertile soils is harvesting of the crop at an increased rotation, let us say, 60 or 70 instead of 40 years.

In the present study, volumes were calculated without bark. In the event pulpwood is purchased unpeeled, additional reductions

TABLE 4.—SOLID VOLUME, WEIGHT, AND CONTENT OF ALPHA-CELLULOSE OF JACK PINE PULPWOOD PRODUCED ON DIFFERENT SITES, AS CALCULATED ON A PER CORD AND PER ACRE BASIS

Type of soil and ground vegetation, and average site index	Solid volume per cord	Weight of wood per cord	Content of alpha-cellulose per cord	Yield of wood per acre	Yield of alpha-cellulose per acre
	Cubic feet	*Pounds*	*Pounds*	*Tons*	*Tons*
Aeolian sand ..... *Cladonia* T. S.I. 45	88.5	2,221	906	7.66	3.12
Melanized sand ..... *Arctostaphylos-Ceanothus* T. S.I. 52	92.0	2,282	968	12.78	5.41
Podzolic sand ..... *Gaultheria-Maianthemum* T. S.I. 63	93.3	2,239	973	15.90	6.91
Gley-podzolic sand ..... *Vacc.-Cornus-Rubus* T. S.I. 68	93.7	2,277	979	18.22	7.83
Moss peat ..... *Sphagnum-Ledum* T. S.I. 45	87.7	2,184	960	10.05	4.42

should be made for wood produced on infertile soils because the percentage of bark is inversely proportional to the diameters of trees.

From an ecological standpoint, the results of the study conspicuously illustrate the beneficial effect of both the podzolization process and favorably located ground water table. With regard to the interests of Wisconsin silviculture, it was gratifying to learn that stands of jack pine on coarse melanized soils—an extensive soil type available for forestry use—show very satisfactory quantitative as well as qualitative production of pulpwood.

Literature Cited

1. ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS. 1945. Official and tentative methods of analysis. Ed. 6. Washington, D. C.
2. GEVORKIANTZ, S. R. 1947. Growth and yield of jack pine in the Lake States. Station Paper No. 7: 11 pp. Lake States Forest Exp. Sta., St. Paul, Minn.
3. SAARI, E., V. KELTIKANGAS, and E. VUOTI. 1939. Knusi- ja mäntypaperipuiden pinotiheys ja kuorimiskukka. Metsätaloudellinen Aikakauslehti. Helsinki, Finland.
4. TAPION TASKUKIRJA. 1949. Ed. 12. Keskusmetsäseura Tapio. Helsinki, Finland.
5. T.A.P.P.I. 1936. Techn. Assoc. Method T203m.
6. TRUOG, E. 1946. Directions for soil analysis. Soils Dept., Univ. Wisc., Madison. (Mimeographed.)
7. WILDE, S. A. 1950. A simple soil air permeameter. Agronomy Jour. 42:522.
8. ———. 1951. Floristic analysis of ground cover vegetation by a rapid chain method for use in silviculture, soil survey, and wildlife management. Techn. Notes No. 36. State Cons. Dept. and Coll. of Agr., Univ. Wisc., Madison.
9. WILDE, S. A. and B. H. PAUL. 1948. Growth, specific gravity, and chemical composition of quaking aspen on different soil types. SR-12: 9 pp. Forest Products Laboratory, Madison, Wisc.
10. ———. 1950. Rate of growth and composition of wood of quaking and largetooth aspen in relation to soil fertility. Trans. Wisc. Acad. Sci., Arts, and Lett. Vol. 40, II.
11. WILDE, S. A., F. G. WILSON, and D. P. WHITE. 1949. Soils of Wisconsin in Relation to Silviculture. Wisc. Conservation Dept. Pub. No. 525-49, Madison.

The Hydrologic and Climatic Influence of the Forest is Basic to the Concept of Forestry[1]

Raphael Zon

THE FOREST like vast stretches of water, lakes, and rivers, is a natural geographic phenomenon and as such is an integral part of the balance of nature. To look upon the forest merely as a source of raw material is not only to narrow the entire field of forestry but to discard the most potent tool man has in controlling the water resources and in ameliorating the extremes of local climatic conditions. Moreover, the practice of good silviculture and the functioning of the forest as a protective cover are not only compatible but are complementary to each other. The better and more vigorous the growth of the forest the greater generally is its protective value. Poor silvicutural practices on the other hand reduce the productivity of the forest and with it the value of its protection.

In a general way we have known this for years. In our popular publications, in our public speeches we professed this belief in the influence of the forest, but in actual practice we failed to translate it into positive action. The fault was not entirely ours. Several other agencies were concerned with the problem of climate, with flood control, with erosion, and other phases of water use. The meteorologists, viewing the climate over vast territories as due to cosmic causes, refused to attribute to forest planting or to forest destruction any influence on the micro-climate of the surrounding country. The geologists who looked upon erosion as a normal geological process in leveling mountains were not willing to concede the beneficial effect of forests in stopping erosion; especially when they could point with justice to large stretches of fertile lands, built up by deposits of soil eroded from the mountains—like the delta of the lower Mississippi River. Army engineers, accustomed to build large engineering works, sought to control the brute force of onrushing water by building levees and dams. The idea that in the control of streamflow there enters, besides physical and mechanical means, also a biological factor, was for a long time foreign to most engineers. The possibility that the rational approach to flood control involves not merely the building of dams and other engineering work at the lower stretches, but also forest works at the upper reaches of the streams or even at their very source was rejected as of secondary and minor importance. A further difficulty was that while, on small watersheds with all the conditions under control, the effect of the forest cover upon reducing surface runoff, stopping erosion, and increasing ground waters could be demonstrated with a certain degree of definiteness and accuracy, when it came to large watersheds, thousands of square miles in extent, the effect of the forests was obscured by other factors; yet what is true of parts should be true also of the whole. It is doubtful if on large watersheds the effect of the forests can ever be ascertained with mathematical precision because of the complexity of many other factors operating over large territories. Yet certain facts such as the amount of sediment carried by streams fed from forested and non-forested watersheds can and have been convincingly demonstrated.

Foresters had to fight their way inch by inch, first against one federal bureau, then against another. To appreciate fully the situation

[1]Paper presented at a meeting of the Division of Watershed Management, Society of American Foresters, Washington, D. C., December 15, 1950.

one must recall that in 1905 there were 20-odd government organizations which had to do with natural resources. Each government agency was a separate watertight compartment and was riding its own hobby in its own direction. Every bureau chief was for himself, fighting each other for place and credit, and funds and jurisdiction. When the foresters, newcomers in the field, began to preach the philosophy of interrelationship between the natural resources, began to point out the relation of the forests to streams and in land navigation, to flood control and water power, to the soil and its erosion, to fish and game, and many another possible use or waste of natural resources, they naturally trod on the toes of the old bureaus and received more than their full share of hostility from them. This was not only an idealogical but often a personal and even a political struggle. Out of the fight with the Geological Survey over the protective value of the forest there emerged finally in 1911 the Weeks Law. What made this federal legislation possible was the proof that forests do affect the flow of streams. To settle the dispute as to the effect of the forest upon erosion, surface runoff, and ground waters the Weather Bureau, in cooperation with the Forest Service, carried on for a number of years observations and measurements on two small similar watersheds in the Rockies near Wagon Wheel Gap, Colorado. The results were fairly indicative but not striking.

The Inland Waterways Commission came into existence in 1906 as a direct attempt to bring some order and planning in the improvement of navigable streams, which then, as it is now, was in charge of the Army Corps of Engineers. The commission pointed out that it was impossible to frame a plan for the control of our rivers without taking account of the orderly development of other natural resources including the forests. This commission became the forerunner of other later organizations dealing with the water resources of the country and paved the way for the Tennessee Valley Authority. In all these fights the foresters, as personified in the then chief of the Forest Service, Gifford Pinchot, bore the brunt of the battles, were the sparkplugs and the leaders of this movement. Many useful investigations on the relation of forests to climate, erosion, and streamflow were born of this campaign. Most of the old antagonism and hostility on the part of the other bureaus has now largely disappeared; but with the passing of Gifford Pinchot and Theodore Roosevelt from the scene, the dynamism of the movement itself has slackened. The foresters themselves are not without blame for this. As a matter of fact we did not even take a full advantage of the law that established the constitutional basis for the purchase of private forest lands by the federal government for protection purposes. The reasoning behind the law was that, since it is a federal function to care for our streams and rivers and since forests are essential to such control, it is legitimate and proper for the federal government to purchase such land.

No sooner did this law pass, however, but we forgot its provisions and began buying land here and there irrespective whether it served as protection forests or not. For a time we followed the policy —the worst first. As realtors we proved a huge success and made valuable investments for Uncle Sam. I wonder, however, how many critical watersheds were completely acquired as a result of such a policy .The fact is that today the United States is one of the few if not the only one, of all civilized countries that has not any forests formally and legally designated as protection forests with definitely laid down plans for their management.[2] The role of the forest in regulating the circulation of water and in moderating extremes of local climates has not yet permeated deeply into the consciousness of the average forester. The subject of forest influences receives but slight consideration in many of our forestry schools. This has been painfully brought home, at least personally to me, in the case of the shelterbelt project initiated by President Franklin D. Roosevelt in the early thirties. The attitude of some professors in some of our leading schools was more than skeptical, it was, almost inimical. Yet today the planted shelterbelts stand out as one of the most lasting achievements of the New Deal and has the support of the overwhelming majority of the farmers in the prairie region—a support borne out of their own experience.

The whole concept of watershed management is still very vague in the minds of many practicing foresters and engineers. It is not one single operation, it is made up of many seemingly small activities; yet it is through the combined effect of all these activities that the main purpose is attained. It is fire control, but it is also making sure that the litter is not lost in clear cutting; it is reforestation, but it is also watching logging to see that gullies are not formed; it is making sure that the range and the pastures are not overgrazed. It may be check dams, but it is also watching road construction to insure that water diversion will not do damage. Such day-to-day thoughts do not come easy unless one has the feel and understanding of plant and water relation and of the influence of land treatment upon water movement through the soil. The saying of the naturalists that *Natura magna est in minimis*, which in free translation means that nature performs its great works through a myriad of minute activities, is nowhere more aptly applied than in the case of watershed management.

There are, however, many hopeful signs on the horizon that bespeak a growing understanding

[2]There is one notable exception, outside the continental United States. In 1903, in Hawaii a law was passed providing for organized watershed management to protect the water supply for the sugar cane industries, the main industries of the territory. Since 1904 the law and a continuing program has been in effect, first under Ralph S. Hosmer, later under Charles S. Judd, and today under William Crosby, territorial foresters. The forest reserves total over one million acres, more than one-fourth of the total area of the eight islands constituting the territory.

and appreciation of the role of the forest. Many army and civilian engineers have come out openly for the foresters' approach to watershed flood control work. This is especially true of sanitary engineers. They know what silt does to their works, they know the value of regular flow, and they appreciate to the full the value of forests. There are many federal and state organizations which give serious attention to watershed problems as they exist on specific river basins. Splendid studies are made on ground waters, sedimentation, infiltration, snow accumulation in the mountains, and other similar problems at forest experiment stations and elsewhere. The U. S. Department of Agriculture recognizes the importance of the watershed approach and is spending, through the Production and Marketing Administration, large sums of money in the form of subsidies to the farmers for not ruining the soil and for not running down their woodlots. All this is to the good. While these studies and activities are going on and will continue to be carried on, it seems to me that we have accumulated by this time a sufficient fund of knowledge and techniques that could be applied without further delay at least on forested watersheds within the national, state, and county forests. Specific measures and practices should be prescribed that would tend to enhance and not diminish the watershed services; there should be instilled in the forest field personnel full realization of the importance of such measures and the need of rigid adherence to them. But above all we need a unified program of action that could be put into effect with regard to all forests whose chief function is that of protection.

Of late years, foresters have lost much of the leadership in the field of water conservation in which they once were pioneers. May the Society's new Division of Watershed Management become the instrumentality through which this leadership may be regained by constructive thinking and bold, imaginative planning. The task, I realize, is a difficult one. Foresters will have to do battle against the mechanistic attitude of the engineer, seek to inject the biological approach in the solution of watershed problems, and also fight their way through the brush of still too much suspicion, antagonism, and distrust that exist among the various organizations working in the field of water conservation. If, however, out of these efforts there will emerge eventually a balanced harmonious watershed protection program, in which the engineer, the soil scientist, the foresters, the hydrologist, and all other specialists will find ample opportunities for performing their important respective tasks, the efforts will have not been in vain.

Important Notice to Subscribers

If you change your address please notify the JOURNAL OF FORESTRY, preferably in advance, by letter, post card, or post office form number 225. Be sure to give your old, as well as the new, address with your postal zone number if any.

You should also notify your local post office on postal form number 22 of your change of address. Both postal forms are obtainable at any post office.

Copies of the JOURNAL will not be forwarded by the Post Office Department. Hence, in order to avoid missing your copy as well as to prevent extra expense to the Society in supplying duplicates, you are urged to notify the JOURNAL as soon as you know your new address, preferably a month in advance.

JOURNAL OF FORESTRY
825 Mills Building
17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

Thinning in Old-Field Virginia Pine

William D. Miller
School of Forestry, North Carolina State College, Raleigh.

Thinning experiments have been conducted in old-field Virginia pine (Pinus virginiana Mill.*) on the Hill Forest in Durham County, North Carolina, since 1932.*[1] *The thinned stands were from 5 to 37 years of age and the densities of the younger stands ranged from 4,000 to 9,000 stems per acre at the time of thinning. These studies showed that, in the North Carolina Piedmont, thinning in old-field Virginia pine 12 years old or older is not practical, because of poor growth response and the hazard of sleet and wind damage. Thinnings in stands 5 to 6 years old resulted in accelerated growth without sleet damage.*

In North Carolina, Virginia pine is found chiefly in the upper Piedmont. The Hill Forest is located in a finger-like projection of the type extending from the Virginia line in a southeasterly direction into Person and Durham counties.

The stands studied are on soils of the Georgeville and Alamance series.[2] These soils, derived from slate and characterized by B horizons of friable clay, are considered good forest soils. Much of the Hill Forest, including all the thinning plots, was formerly in cultivation. Some of this land was abandoned soon after the Civil War, and some within the past 25 years. Soil tests show that the old fields range from low to medium in calcium, phosphorus, potassium, and organic matter, based on agricultural standards. Soils which had never been cultivated or which had been out of cultivation 50 or more years commonly showed higher values in these tests than did soils more recently in cultivation. The soils were slightly acid, ranging from 4.6 to 5.9 in pH.

Growth and Sleet Damage in Thinned Plots

The various experimental results are presented in the order of stand age at the time of thinning.

Thinning at 5 years.—A thinning was made in 1936 in a 5-year-old stand of 9,000 stems per acre, averaging 10 feet in height (Plot 1, Table 1). On the quarter-acre plot 470 crop trees were selected at a spacing of approximately 5 feet. No check plot was established because of the small area available.

By the summer of 1939 the canopy was again completely closed. In 1941 a second thinning was made which increased the average spacing to 7 feet. The material removed measured one-half cord of firewood.

Although lacking a check plot for comparison, this plot has responded well to two thinnings and has maintained a thrifty growth rate. At 19 years, it shows a volume of 1,548 cubic feet inside bark per acre, which equals the normal for the Hill Forest.[3]

Thinning at 6 years.—A thinning was made in 1941 in a stand of 5,000 stems per acre (Plot 2). Two eighth-acre plots, with isolation strips, were marked off in 6-foot squares. A crop tree was selected and numbered in each square. One plot was thinned and the other left untreated.

It became evident at the remeasurements of 1946 and 1950 that the crop trees originally chosen on the check plot were not always the best trees. In 1950, therefore, the un-numbered as well as the numbered trees of the check plot were measured. A single table was made, including all trees, and the 130 largest trees were selected for comparison with the 130 trees present on the thinned plot. This procedure was followed on all the check plots in the 1950 remeasurements. Values based on the total number of trees are given in Table 1 for each check plot.

By the time of the second measurement in 1946, the thinned plot had completely closed, and demonstrated a definite superiority in growth over the check plot. In 1950, it showed an average diameter of 3.8 inches, an average height of 30 feet, a basal area of 88 square feet, and a volume of 938 cubic feet inside bark, as compared with 2.9 inches, 28 feet, 50 square feet, and 400 cubic feet inside bark for the check plot.

Conditions on the thinned and check plots in November 1950, are shown photographically in Figures 1 and 2.

Thinning at 12 years.—This thinning was made in 1939 in a stand of 6,000 stems per acre, averaging 18 feet in height (Plot 3). Two quarter-acre plots were marked off in 6-foot squares, and a crop tree selected in each square. One plot was thinned, and one left as a check. Material removed amounted to 1½ to 2 cords of firewood per acre.

The 1944 data show a slightly larger growth response for the thinned plot; in 1950, however, the check plot was slightly superior. The discrepancy may have resulted from the fact that the check plot data for 1944 were based on the original numbered crop trees which were still surviving, instead of on the largest trees of the entire plot, as was the case in 1950. No sleet damage occurred on this plot, but when the lack of growth response is considered, the thinning was not justified.

Thinning at 15 years.—This experiment was initiated in a stand of 4,000 stems per acre (Plot 4). One of the tenth-acre plots was thinned to 8-foot spacing while the other was left as a check. The thinned plot was pruned to a height of 12 feet. Material removed constituted 2 cords of firewood per acre.

At the beginning of the experiment the thinned plot had a small advantage over the control in diameter, basal area, and volume, and

[1] These studies were initiated by R. W. Hayes, J. V. Hofmann, W. D. Miller, and G. K. Slocum.

[2] U. S. Dept. Agric. Yearbook of Agriculture. 1938.

[3] Actual and normal volume obtained from unpublished tables by G. K. Slocum.

TABLE 1.—GROWTH OF VIRGINIA PINE ON THINNED AND UNTHINNED PLOTS

Plot No.	Area	Year	Age	Treatment	Spacing after thinning	No. of trees	Average d.b.h.	Average dominant height	Basal area per acre	Volume per acre Inside bark	Volume per acre Outside bark
	Acres		*Years*				*Inches*	*Feet*	*Square feet*	*Cubic feet*	
1	0.25	1936	5	Thinned 1936	5x5	470	1.2	10	14	----	----
		1941	10	Thinned 1936		437	2.6	27	69	570	845
		1941	10	Thinned 1941	7x7	230	3.0	27	47	415	580
		1946	15	Thinned 1941		220	4.0	33	81	992	1,189
		1950	19	Thinned 1941		212	4.6	40	104	1,548	1,812
2A	0.125	1941	6	Thinned 1941	6x6	133	0.6	7	3	----	----
		1946	11	Thinned 1941		133	3.0	17	56	302	438
		1950	15	Thinned 1941		130	3.8	30	88	938	1,142
2B	0.125	1941	6	Unthinned		149[1]	0.5	7	3	----	----
		1946	11	Unthinned		149	1.9	15	26	135	262
		1950	15	Unthinned		130	2.9	28	50	400	587
		1950	15	(All trees)		488	1.9	28	92	663	1,114
3A	0.25	1939	12	Thinned 1939	6x6	295	2.3	18	38	238	377
		1944	17	Thinned 1939		290	3.5	30	81	772	940
		1950	23	Thinned 1939		285	4.3	39	124	1,743	2,057
3B	0.25	1939	12	Unthinned		270	2.7	19	45	304	439
		1944	17	Unthinned		263	3.3	30	71	667	893
		1950	23	Unthinned		285[1]	4.3	40	125	1,933	2,276
		1950	23	(All trees)		497	3.5	40	151	2,162	2,676
4A	0.1	1936	15	Thinned 1936	8x8	68	3.4	28	46	427	544
		1941	20	Thinned 1936		68	4.3	34	71	891	1,051
		1946	25	Thinned 1936		67	5.0	43	96	1,716	1,940
		1950	29	Thinned 1936		64	5.7	46	118	2,329	2,590
4B	0.1	1936	15	Unthinned		64	3.3	24	40	324	439
		1941	20	Unthinned		64	4.0	38	56	810	982
		1946	25	Unthinned		60	4.5	45	68	1,181	1,391
		1950	29	Unthinned		64[1]	5.2	45	96	1,769	1,980
		1950	29	(All trees)		187	3.8	45	163	2,621	3,053

[1]Check plot computations before 1950 were based on tagged crop trees only. In 1950, they were based on that number of the largest trees, tagged or untagged, which corresponded to the number of trees present on the thinned plot.

the initial advantage in cubic-foot volume increased in the course of 14 years. In percentage of volume increase, however, the thinned plot was exceeded by the unthinned plot. No sleet damage resulted from this thinning, but the expense of the operation was not justified by the resulting growth.

Conditions on these plots in November 1950, are shown in Figures 3 and 4.

The comparisons given above are based upon crop trees only. When all trees on the check plots are included, the effect is to lower the average diameter and to increase substantially the basal area and volume. The non-crop trees do not add directly to quality production, but they do reduce the danger of sleet damage, improve natural pruning, increase the gross cubic foot volume, and apparently have very little retarding effect on the development of crop trees after 6 or 7 years of age.

FIG. 1.—Plot 2A, thinned to 6-foot spacing at 6 years of age. The stand as shown is 15 years old, and has an average d.b.h. of 3.8 inches. The tendency of Virginia pine to retain its lower limbs tenaciously has been encouraged by thinning. The tree in the left foreground was pruned to clear the view.

Photos. by C. M. Kaufman.

FIG. 2.—Plot 2B, unthinned, at 15 years of age. The average d.b.h. of crop trees is 2.9 inches. Compare with Figure 1, which shows the thinned plot at the same age.

FIG. 3.—Plot 4A, thinned to 8-foot spacing and pruned at 15 years of age. The stand as shown above is 29 years old and has an average d.b.h. of 5.7 inches.

FIG. 4.—Plot 4B, unthinned, at 29 years of age. The average d.b.h. of crop trees is 5.2 inches. Compare with Figure 3, showing the thinned plot at the same age.

Thinning at 21 years.—This thinning was made in 1933 in a well-stocked stand. Enough of the less promising trees were removed from the half-acre plot to give the best trees a moderate degree of release. No check plot was established.

In the winter of 1935-36 severe sleet storms bent or broke many trees on the south half of this plot. The north portion of the plot had suffered comparatively light damage, probably because of greater density, and was re-established as a quarter-acre growth study plot in the summer of 1936.

Thinning at 24 years.—In 1932, a series of thinning plots was laid out in a 24-year-old stand. Three quarter-acres were thinned by the following methods:

1. Removal of all trees above the average diameter.
2. Removal of all trees below the average diameter.
3. Selection of the most promising crop trees and removal of all others.

A fourth plot was left untreated. The sleet storms of 1935-36 caused such extensive damage in all three of the thinned plots that they were clearcut for pulpwood. The check plot, however, suffered no damage except for a few bent or broken trees along the boundary. In the summer of 1936 the check plot was re-established as a quarter-acre growth-study plot.

Thinning at 37 years.—A plot was established in November 1933, for the study of crown development after thinning in Virginia pine. Five and one-half cords of pine were removed from a half-acre in a 37-year-old stand, leaving 144 trees averaging 8 inches d.b.h. and 60 feet in height. This density allowed ample room for crown expansion. Measurements of length and width of crown were made

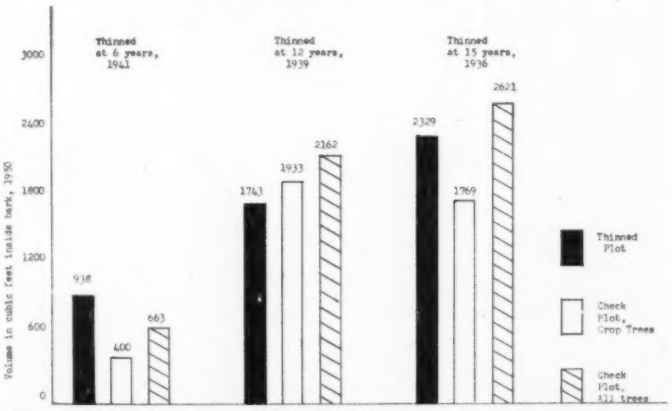


FIG. 5.—Volume growth on thinned and check plots.

with a transit, using permanent hubs. The plan called for remeasurement at regular intervals, but because of a change in personnel the remeasurements were not made.

Ocular estimates from time to time indicated that the tree crowns did not begin to grow into the spaces made available for them. Ocular observations are not a substitute for transit measurements, but if there had been any substantial response to thinning, it would have been noticeable without the aid of instruments. The slow or negligible response to thinning is in accord with the usual behavior of Virginia pine on the Hill Forest.

Sleet damage occurred in this plot in 1935-36 and several trees were bent, broken, or uprooted. The stand was cut for pulpwood in 1944.

All the thinnings described above were made for experimental purposes only, and the material cut was not utilized. From the standpoint of possible commercial value, the thinnings at 5, 6, 12, and 15 years of age produced nothing of merchantable size. The thinning at 37 years yielded 11 cords per acre, in trees ranging from 3 to 11 inches in diameter and averaging 6½ inches. Data on volume removed are not available for the thinnings at 21 and 24 years.

Discussion

These results emphasize two characteristics of Virginia pine.

First.—Openings in the canopy following thinning are closed with reasonable promptness only during a short period in early life. The plot thinned at 5 years closed its canopy within 3 years and also responded well to a second thinning at 10 years. The plot thinned at 6 years closed its canopy within 5 years and showed increased growth in height, diameter, and volume as a result of thinning. Plots thinned at 12 and 15 years had not completely closed their canopies in 11 and 14 years, respectively, and showed no economic gain from thinning. The plot thinned at 37 years failed to show perceptible response to the opening of the canopy.

The growth obtained in those experiments which included thinning plots and permanent check plots is shown by bar diagrams in Figure 5.

Second.—Opening Virginia pine stands makes them very susceptible to sleet damage. Sleet storms are common in the area extending from Durham to Winston-Salem. In dense old-field stands such as those here described, the individual trees are dependent on each other for support. Thinning or any other occurrence which opens the stand reduces this support and increases the chances of damage by sleet or wind. The maintenance of a closed canopy is the best protection against this type of injury.

As to whether stands thinned at an early age will suffer sleet damage, one of the early thinning experiments provided a small-scale test. This plot was thinned in 1941 at 6 years of age. In the winter of 1942-43, sleet storms caused extensive damage on the Hill Forest, but this thinning plot, 7 years old, was unharmed.

The best stands of Virginia pine on the Hill Forest started with high densities, approaching 10,000 trees per acre, and maintained dense canopies until maturity. The results of the thinning experiments indicate that the reduction of stand density by thinning leads to damage by wind and sleet and produces no appreciable increase in growth rate unless made in the very early life of the stand.

The expected advantages of thinning are: (1) production of larger sizes by concentrating the growth on a smaller number of selected trees; (2) receipt of early financial returns; (3) shortening of the rotation; (4) salvaging of material which would otherwise be lost; and (5) improvement of the health and quality of the stand by removal of defective and unthrifty trees.[4]

These advantages have been obtained from thinnings in such species as white pine and loblolly pine.

In Virginia pine, thinning does not lead to the production of larger sizes unless made at a very early age. Indications are that response of the species to thinning is not strong enough to bring about a shortening of the rotation. The other advantages are all offset by the risk of sleet damage which is incurred by thinning, unless made in the first 6 or 7 years.

[4]Hawley, R. C. The practice of silviculture. Fifth edition. 1946.

Professional Esprit de Corps

The competence and loyalty of the foresters throughout the land, and the high esteem in which they are held, are a direct result of the educational and professional program set in motion by men like Gifford Pinchot and B. E. Fernow at the beginning of the forest program. Detailed studies in the field, made in the course of this study, show also that the efficiency of forest administration and the co-ordination of decentralized operations out to the most isolated post arise not only from the administrative controls, but also from this unity of professional education, and the common indoctrination as to broad objectives and techniques.

From *American Forest Policy* by
LUTHER H. GULICK, 1951.

Yellowpoplar Lumber Grade Yield Recovery —A Guide to Improved Cutting Practices[1]

Gilbert H. Fechner
Division of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.

A RECENT STUDY of sample sawmills in the Tennessee Valley indicates that 45 percent of the yellowpoplar trees (*Liriodendron tulipfera*) being cut for lumber yield butt logs having an inside bark diameter of 12 inches or less. Over half of these trees (24 percent of all yellowpoplar trees cut for lumber) were small, defect free, and fast growing. Had they been left as growing stock, total lumber production would have been reduced just 4.4 percent. Lumber value per thousand board feet would have been reduced only 0.2 percent. If they had been left and allowed to grow for 10 years, value increment would have averaged 8 percent a year.

The trend in timber management is toward *quality* production rather than quantity alone, and rightly so. In view of our ever-dwindling supply of virgin timber, with its inherent high quality, we must now concentrate on producing high quality timber in second-growth stands. Over and above this basic fact, our attention is increasingly focused on quality by the gradual but sure evolution of log and tree grading schemes. Many forest products industries have developed their own log specifications. We recognize special use classifications for logs of different species and different sections of the tree. Perhaps the most comprehensive set of hardwood log grading rules so far published is that developed by the Forest Products Laboratory (*12*).

We are learning more about lumber grade yield recovery. But we need much more information if log and tree grades are to become recognized media of exchange in the forest products industry, and if such grades are to serve as guides to management and harvesting practices.

Much of the nation's hardwood forest area is in small private holdings. In the Tennessee Valley, for example, about 40 percent of the total forest area is on farms (*11*). On such properties, cutting practices are largely controlled by the small sawmill operator. So, we must look to these small mills as the source of information on specific log quality and cutting practices in general.

The purpose of this report is threefold: (1) to furnish additional lumber grade yield recovery data on yellowpoplar, (2) to show the actual quality of yellowpoplar being cut by small mills in the Tennessee Valley, and (3) to suggest possible methods of improving quality on the ground and at the mill.

Growth Habits and Uses of Yellowpoplar

Because of its wide use, yellowpoplar is often listed as one of our most valuable hardwoods. In the Tennessee Valley, its primary use is in furniture (Table 1), but it also enters the millwork, casket, and crating fields. It is often substituted for softwoods as framing, siding, and other planing mill products. Thinning operations are being made economically possible by its increased use as a pulping species.

In 1945 yellowpoplar ranked third in volume among all hardwood species in the nation, with a total production of 578,463,000 board feet (*10*). It was surpassed only by the oaks (*Quercus*) and sweet gum (*Liquidambar styraciflua*). That year it accounted for more than 8 percent of the total hardwood cut.

TABLE 1.—USES OF YELLOWPOPLAR BY INDUSTRIES OTHER THAN PLANING MILLS AND SAWMILLS IN THE TENNESSEE VALLEY—1946

Product	Percent
Furniture[1]	49
Wood pulp	24
Caskets and burial boxes	12
Wooden containers[2]	9
Millwork	3
Miscellaneous[3]	3
Total	100

[1]Includes furniture, furniture parts, furniture dimension, and turnings.
[2]Includes baskets, boxes and crates, and tobacco hogsheads.
[3]Includes broom and mop handles, core stock, veneer, ironing boards, mine wedges, novelties, truck beds and farm wagons, curtain stretchers, bee hives, boats, and excelsior.

The environmental requirements and growth habits of yellowpoplar are conducive to high quality timber production, but these same characteristics make it difficult to perpetuate. Being very intolerant, the tree drops its lower branches early in life, leaving a long clear bole with little taper and a minimum of defect. McCarthy (*7*) found that the crown may account for as little as 1/16 of the total height of the tree.

This same intolerance to competition eliminates the possibility of developing the species as an understory. As McCarthy (*7*) points out, yellowpoplar seedlings can persist no longer than 3 years under the parent canopy; they can only survive under the light shade of grass and shrubs in old fields.

Typically a cove hardwood, yellowpoplar requires a deep, well-drained, moist soil for best development. Auten (*2*) found that height growth is best in sheltered coves and diminishes according to the following site classification: sheltered cove, open cove, sheltered slope, open slope, flat terrain, and ridge. When yellowpoplar is grown under most favorable conditions, few other hardwoods show equal vigor (*7*).

Scope of Study

Between July 1949 and June 1950, Tennessee Valley Authority foresters conducted a log grade and lumber grade yield recovery study[2] at small circular sawmills throughout the Tennessee River watershed. Observations covered 100 operating

[1]This paper won first place in the Kentucky-Tennessee Section's Junior Member report writing contest in 1950.

[2]In cooperation with members of the staff of the Southern Forest Experiment Station, New Orleans; National Hardwood Lumber Association, Chicago; Southern Pine Inspection Bureau, New Orleans.

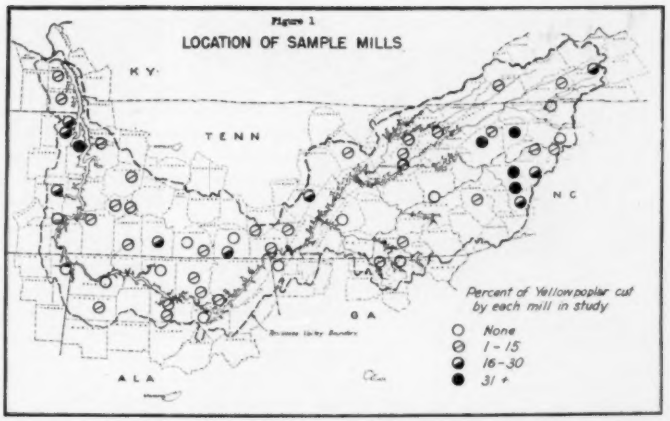
days at 58 mills, each producing from 250 to 3,000 Mbf. of lumber and ties annually. Mills in this class account for approximately 67 percent of the total lumber and tie production in the Tennessee Valley. The sample included 5.1 percent of the sawmills in the 250 to 3,000 Mbf. production class and 1.7 percent of all the sawmills in the area.

At each mill all the logs cut during the observation period were scaled by the International ¼-inch log rule and graded according to log grades published by the Forest Products Laboratory (*12*) and the Southeastern Forest Experiment Station (*9*). Log grades 1, 2, and 3 are the same as those published by the Forest Products Laboratory. Grade 4 was added to cover the local use log, the one that meets size specifications but not cutting requirements. Grade 5 is for culls. Grade 6 covers those logs not meeting size requirements.

Lumber was graded according to National Hardwood Lumber Association standards (*8*) and tallied separately for each log. Additional information on each log included position (butt or upper), scale deduction, method of manufacture, sawing time, and growth rate. The cause of degrade was also noted for all butt logs not of top quality.

Cooperating mills were statistically chosen by sections of states, according to the lumber production of each section. Of the 58 contacted, 45 were cutting some yellowpoplar (Fig. 1).

Figure 1



The Tennessee Valley, lying entirely within the region of best growth of yellowpoplar (Fig. 2), produced 581,063 Mbf. of hardwoods in 1946. Of this total, 74,621 Mbf. or 12.8 percent was yellowpoplar.

Inventory of Logs and Lumber

On the basis of the sample study, the average yellowpoplar log now being cut by small circular sawmills in the Tennessee Valley lies between Grade 2 and 3. It is approximately 12 inches d.i.b. and 12 feet long; it yields about 70 board feet of lumber—37.4 percent No. 1. Common and Better (Table 2). Nearly one-fifth of the logs do not meet factory log grade requirements.[3]

It seems reasonable to assume that the butt logs sawed in a day's sawmill run represent fairly accurately the number of stems involved in the total volume. If this is true, the sample of 979 logs came from 264 trees (Table 2). This means the average yellowpoplar tree cut in this area contains approximately 2½ logs (16 feet long). The prevalence of logs less than 8 feet in length is indicated by the lumber grade yield recovery of Grade 6 logs.

Log Defects

Defects in logs of factory lumber quality are those deviations from the normal that indicate some imperfection in the wood and limit clear face cuttings. These defects may be the result of natural growth processes or of injury. Knots, bumps, holes, and seams are only a few that might be encountered.

Lockard, Putnam, and Carpen-

[3]The No. 1 Common and Better lumber yield for factory log Grades 1, 2, and 3 is 66.8, 43.9 and 21.4 percent respectively.

TABLE 2.—PERCENT LUMBER GRADE YIELD RECOVERY BY LOG GRADES—YELLOWPOPLAR

Log grade	No. 1 Common and Better						2A and Below					Basis	
	FAS	Sel.	No. 1	Saps	Stained saps	Total	2A	2B	3A	3B	Timb.	Total	Logs	Board feet
All Logs														
1	2.7	4.6	43.2	16.2	0.1	66.8	24.1	7.1	1.4	0.6	—	33.2	89	14,311
2	0.3	1.8	36.7	5.0	0.1	43.9	39.8	13.7	1.8	0.8	—	56.1	242	21,294
3	—	0.4	19.1	1.9	—	21.4	42.2	30.7	3.0	2.3	0.4	78.6	460	23,823
4	—	—	6.5	0.2	—	6.7	43.2	37.9	10.0	2.0	0.2	93.3	87	3,879
5	—	—	5.2	—	—	5.2	35.7	54.6	2.8	1.7	—	94.8	21	883
6	—	—	10.1	0.3	—	10.4	19.3	47.9	14.3	7.0	1.1	89.6	80	1,401
All	0.7	1.8	28.9	5.9	0.1	37.4	36.9	21.1	2.9	1.5	0.2	62.6	979	65,591
Butt Logs Only														
1	2.5	3.9	43.7	17.8	0.1	68.0	24.6	5.6	1.1	0.7	—	32.0	66	9,834
2	0.4	1.2	42.2	7.5	0.2	51.5	34.6	11.4	1.6	0.9	—	48.5	103	8,434
3	—	0.1	30.2	3.9	—	34.2	37.6	21.8	3.1	1.2	2.1	65.8	83	4,770
4	—	—	—	—	—	—	61.1	16.7	22.2	—	—	100.0	1	36
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	35.5	0.8	—	36.3	16.5	29.0	11.4	6.8	—	63.7	11	352
All	1.2	2.1	40.2	11.0	0.1	54.5	30.8	11.4	1.8	1.0	0.4	45.5	264	23,426

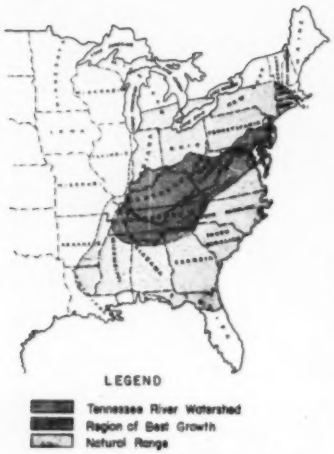


FIG. 2.—Range of yellowpoplar.

ter (*6*) have described defects in southern hardwoods in detail. However, a few are more or less peculiar to yellowpoplar. Bird peck, knots, and fire scars are perhaps the most frequently encountered.

Bird peck, the work of sapsuckers, may occur in bands around the tree or it may completely cover the bark (Fig. 3) (*6*). The holes may be old or of recent origin. Old peck holes become occluded with callous tissue. Frequently a tree once pecked is pecked repeatedly throughout its life. Peck shows up on the end of a log as black spots in tangential lines (Fig. 4).

The wood of heavily pecked trees becomes 2B Common lumber because the pecks and accompanying stain are not admitted in clear face cuttings. When bird peck reaches an intensity of 4 or more holes per square foot, log Grades 1 and 2 are lowered one grade (*12*). Bird-pecked trees are not quality producers, and repeated peck prevents their being potential quality producers.

Knots are common defects in all species. Their presence in lumber automatically limits clear cuttings. By virtue of its intolerance, yellowpoplar is reasonably free of knots, and we know that their number can be minimized by maintaining reasonably dense stands, especially in youth.

Epicormic branches, or water sprouts, are also log defects for the same reasons as knots. Jemison and Hepting (*5*) say that thinning should be postponed until the stand is past 20 years of age, when epicormic branches are not so apt to develop. We expect a core of knots, pith, etc., in all logs; but the wider the clear band of quality lumber, the higher is the value of the tree, the stand, and the whole forest resource.

Scars resulting from fire are rather common in yellowpoplar. Such a scar is a defect because of the decay and associated bark pockets normally found in the wood. Mineral stain, often associated with fire wounds, is definitely limited in the higher lumber grades.

No consideration is given to heartwood in present yellowpoplar log grading schemes. But a definite minimum exists on the amount required in FAS and Select Lumber grades. Ashe (*1*) states that soil moisture conditions control the amount and color of the heartwood as follows:

Site	Heartwood conditions
Moist sites	
Fertile coves	Large
Best limestone	Dark brownish-yellow
Dry sites[4]	Small
	Pale yellow to nearly white

Log Quality Index

It is generally accepted that log quality (and consequently value per unit) increases as diameter increases. Ashe (*1*) as early as 1913 pointed out a definite increase in yellowpoplar lumber value as trees increased in d.b.h.

A better indicator of quality is needed. Herrick (*4*) suggests the log quality index. This is computed by multiplying the yield percent of each lumber grade by the percent that grade value is of FAS value[5] and adding these products

[4]May be physically dry or physiologically dry, i.e., sour soils; soils with poor aeration.

[5]Based on recent lumber prices, the following percentages were assigned to the various lumber grades:

FAS	100	2A Common	50
Select	95	2B Common	35
Saps	90	3A Common	25
Stained Saps	70	3B Common	25
No. 1 Common	70	Timbers	35

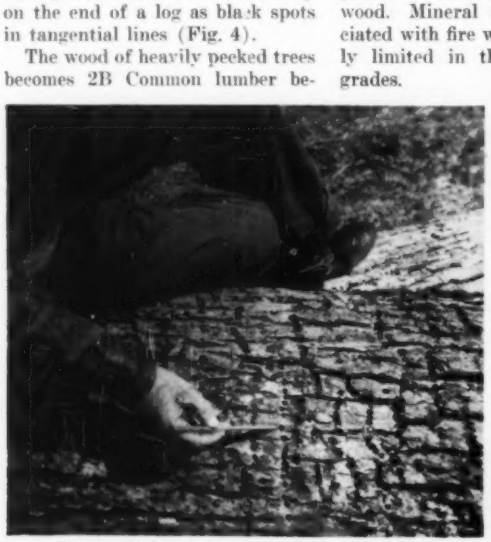


FIG. 3.—Bird peck on surface of yellowpoplar log.

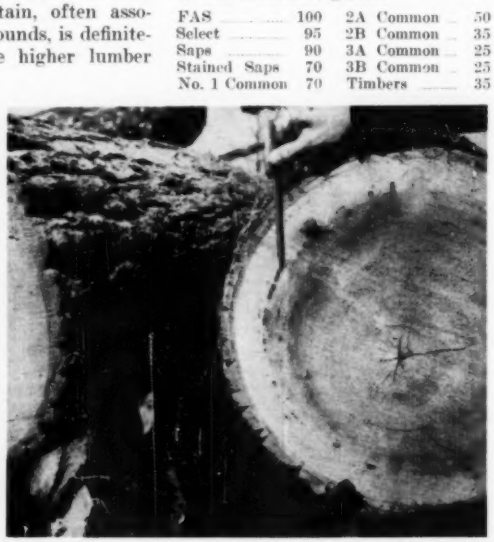


FIG. 4.—Same log as in Fig. 3, showing bird peck on end.

FIG. 5.—Typical knots in tops of open-grown yellowpoplar.

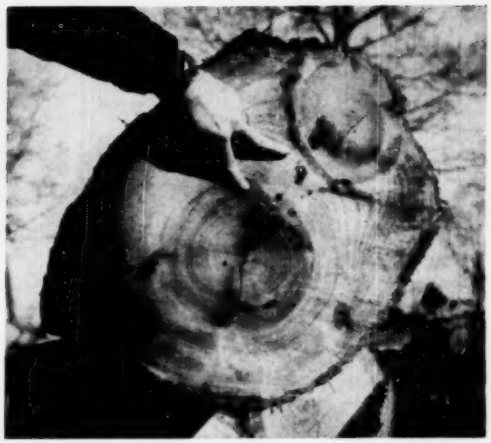


FIG. 6.—Typical knots, sometimes called double heart.

together. Algebraically, the formula then becomes: Q.I. = (% FAS) + (.95) (% Select) + (.90) (% Saps) + (.70) (% No 1 Common and Stnd. Saps) + (.50) (% 2A Common) + (.35) (% 2B Common) + (.25) (% 3A and 3B Common) + (.35) (% Timbers). Figure 7 illustrates graphically the quality indexes for the 3 factory grades, all grades, and for high quality, small butt logs.

Once a log quality index is established for any group of logs (or trees), the current price of FAS lumber and the total volume concerned will yield the value of the resulting lumber. Deducting logging, manufacture, and stumpage costs then gives an indication of profit or loss. These costs may be quite variable and are best applied to individual operations.

Heiberg (*3*) shows the rate of growth necessary to insure a particular interest rate return by diameter classes and tree quality classes (good, medium, and poor) for white pine and hemlock. But so far a truly workable set of hardwood tree grades has not been established. However, the butt log is the key for gauging tree quality or quality potential. Little can be expected from the upper sections of a tree having a low grade butt log.

But not all butt logs have the same potentialities. Certain trees, by virtue of their situation (open-grown, for example) are destined to increase in value only as a result of increased volume. On the other hand, those trees that are increasing in quality are the trees on which we can most economically base the future crop. Unfortunately, too many such trees are being cut.

Using the quality index obtained from the curves in Figure 7, we can reasonably predict the gross percent of value increase for any particular log (and when speaking of small butt logs, we are also speaking of trees). Table 3, including the three factory grades, emphasizes the importance of leaving Grades 2 and 3 butt logs if they show promise of increasing in unit value.

Here is an example to illustrate use of the table. Suppose we have a high quality butt log 11 inches d.i.b. with 6 rings in the outer inch. Being of sufficiently high quality to be Grade 1, except for diameter, this log must necessarily become

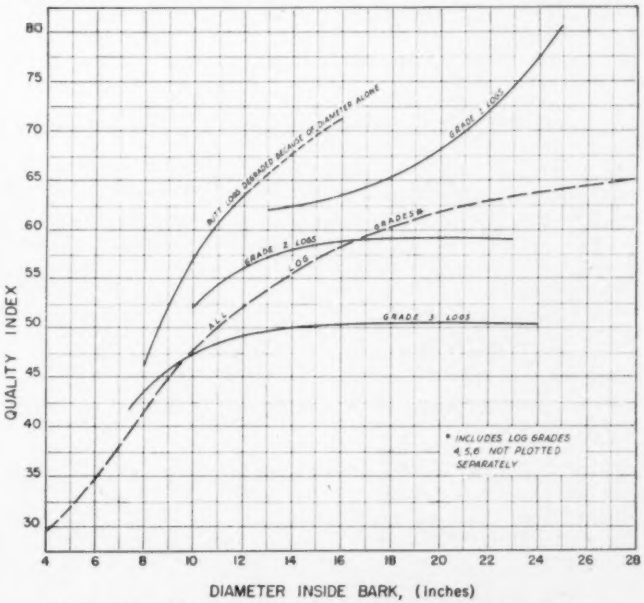


FIG. 7.—Effect of log diameter and log grade on yellowpoplar quality.

TABLE 3.—CORRELATION OF GROWTH RATE AND VALUE INCREASE FOR 12-FOOT YELLOWPOPLAR LOGS 8 TO 16 INCHES D.I.B.

Log items				Butt logs Grades 2 and 3					Grade 1					Butt and upper logs Grade 2					Grade 3				
				Present		5 Years hence			Present		5 Years hence			Present		5 Years hence			Present		5 Years hence		
Present D.i.b.	Present volume	Growth rate	Vol. 5 yrs. hence	Quality index	Value	Quality index	Value	Value increase	Quality index	Value	Quality index	Value	Value increase	Quality index	Value	Quality index	Value	Value increase	Quality index	Value	Quality index	Value	Value increase
Ins.	BF	Rings per outer inch	BF		Dollars		Dollars	Percent		Dollars		Dollars	Percent		Dollars		Dollars	Percent		Dollars		Dollars	Percent
	26			46.0	$1.96														43.5	$1.86			
		6	42			55.7	$3.84	95.9													46.9	$3.23	73.7
		8	38			53.3	3.33	69.9													46.2	2.88	54.8
8		10	35			52.2	3.00	53.1													45.7	2.62	40.9
		12	33			51.0	2.76	40.8													45.4	2.46	32.3
		14	32			50.5	2.65	35.2													45.2	2.37	27.4
		16	31			49.8	2.53	29.1													45.0	2.29	23.1
	35			52.2	$3.00														45.7	$2.62			
		6	53			59.7	$5.19	73.0													48.2	$4.19	59.9
		8	48			57.9	4.56	52.0													47.6	3.75	43.1
9		10	45			57.0	4.21	40.3													47.3	3.49	33.2
		12	43			56.2	3.97	32.3													47.0	3.32	26.7
		14	42			55.7	3.80	26.7													46.9	3.23	23.3
		16	41			55.2	3.71	23.7													46.8	3.15	20.2
	45			57.0	$4.21														47.3	$3.49			
		6	63			62.7	$6.48	53.9													49.0	$5.07	45.3
		8	59			61.3	5.93	40.9													48.7	4.71	35.0
10		10	56			60.7	5.58	32.5													48.5	4.46	27.8
		12	54			60.1	5.32	26.4													48.3	4.28	22.6
		14	53			59.7	5.19	23.3													48.2	4.19	20.1
		16	52			59.4	5.07	20.4													48.1	4.10	17.5
	56			60.7	$5.58									54.4	$5.00				48.5	$4.46			
		6	78			65.1	$8.33	49.3								56.9	$7.28	45.6			49.6	$6.35	42.4
		8	71			63.9	7.44	33.3								56.3	6.56	31.2			49.3	5.74	28.7
11		10	68			63.5	7.09	27.1								56.0	6.25	25.0			49.2	5.49	23.1
		12	66			63.0	6.82	22.2								55.7	6.03	20.6			49.1	5.32	19.3
		14	65			62.7	6.69	20.0								55.6	5.93	18.6			49.0	5.23	17.3
		16	63			62.5	6.46	15.8								55.5	5.74	14.8			48.9	5.06	13.4
	68			63.5	$7.09									56.0	$6.25				49.2	$5.49			
		6	92			67.3	$10.16	43.3								57.8	$8.73	39.7			49.9	$7.58	38.1
		8	86			66.2	9.34	31.7								57.4	8.10	29.6			49.8	7.03	28.0
12		10	82			65.8	8.86	25.0								57.2	7.70	23.2			49.7	6.69	21.9
		12	79			65.3	8.46	19.3								57.0	7.39	18.2			49.6	6.43	17.1
		14	78			65.1	8.33	17.5								56.9	7.28	16.5			49.6	6.35	15.7
		16	77			64.8	8.19	15.5								56.8	7.18	14.9			49.5	6.26	14.0

	82																49.7	$6.69			
					62.1	$8.36				57.2	$7.70								50.2	$8.90	33.0
		6	108				62.7	$11.11	32.9			58.4	$10.35	34.4					50.1	8.22	22.9
		8	100				62.5	10.26	22.7			58.2	9.55	24.0					50.0	7.96	19.0
	13	10	97				62.4	9.93	18.8			58.0	9.23	19.9					50.0	7.72	15.4
		12	94				62.3	9.61	14.9			57.8	8.92	15.8					50.0	7.53	12.6
		14	92				62.3	9.41	12.6			57.7	8.71	13.1					49.9	7.45	11.4
		16	91				62.2	9.29	11.1			57.7	8.61	11.8					49.9		
	97																50.0	$7.96			
		6	124		62.4	$9.93				58.0	$9.23								50.4	$10.26	28.9
		8	117				63.3	$12.88	29.7			58.8	$11.97	29.7					50.3	9.66	21.4
		10	113				63.0	12.10	21.8			58.6	11.25	21.9					50.3	9.33	17.2
	14	12	109				62.9	11.66	17.4			58.5	10.85	17.6					50.3	8.98	12.8
		14	108				62.8	11.23	13.1			58.4	10.45	13.2					50.2	8.90	11.8
		16	106				62.7	11.11	11.9			58.4	10.35	12.1					50.2	8.73	9.7
							62.7	10.90	9.8			58.3	10.14	9.9					50.2		
	113																50.3	$9.33			
		6	142		62.9	$11.66				58.5	$10.85								50.5	$11.77	26.1
		8	134				64.1	$14.94	28.1			59.0	$13.75	26.7					50.4	11.08	18.7
	15	10	130				63.7	14.01	20.1			58.9	12.95	19.3					50.4	10.75	15.2
		12	126				63.5	13.54	16.1			58.9	12.56	15.8					50.4	10.42	11.7
		14	124				63.4	13.11	12.4			58.8	12.16	12.1					50.4	10.26	10.0
		16	122				63.3	12.88	10.5			58.7	11.95	10.1					50.4	10.07	7.9
							63.2	12.65	8.5			58.7	11.75	8.3					50.3		
	130																50.4	$10.75			
		6	162		63.5	$13.54				58.9	$12.56								50.6	$13.45	25.1
		8	153				65.1	$17.30	27.8			59.2	$15.74	25.3					50.5	12.68	17.9
	16	10	148				64.5	16.20	19.6			59.1	14.84	18.1					50.5	12.27	14.1
		12	144				64.4	15.64	15.5			59.1	14.36	14.3					50.5	11.93	11.0
		14	142				64.1	15.15	11.9			59.0	13.94	11.0					50.5	11.77	9.5
		16	141				64.0	14.91	10.1			59.0	13.75	9.5					50.5	11.69	8.7
							63.9	14.79	9.2			59.0	13.65	8.7					50.5		

Grade 2. Its present volume is 56 board feet[6] and its quality index is 60.7, giving a present lumber value of $5.58.[7] Five years of growth at the present rate will make the log 12.7 inches d.i.b. Its volume will then be 78 board feet, its quality index 65.1, its value $8.33. This is a value increase of 49.3 percent, nearly 10 percent a year.

Present Cutting Practices and Suggested Improvements

Table 4 shows the yellowpoplar cut of the 58 sample mills studied. The last column, hourly production rate, is based on the average headsaw time for logs in each diameter class. Actual production per hour would be somewhat less if time between logs and non-productive time were included.

Multiplying value per thousand board feet by hourly production rate gives the maximum gross lumber value per hour. As might be expected, the small logs, because of their low volume and low quality index, appear to be unprofitable. Logs 17 to 18 inches in diameter yield the highest rate for any 2-inch class, $155 per hour of sawing.

Sixty-three small butt logs should not have been cut because of their rapid growth and relatively high quality potential. Leaving them would have reduced the number of stems severed by almost 24 percent. But the total lumber volume would have been reduced only 4.4 percent; its value per thousand board feet have been reduced just 0.2 percent.

At their present rate of growth and quality potential, these 63 trees, if left to grow for 5 years, would have increased in value at the average rate of over 6 percent per year. If left to grow for 10 years, they would have increased at the average annual rate of nearly 8 percent.

In a given stand, then, we have a group of small trees with butt logs of relatively high quality.

[6] International ¼-inch log rule.

[7] Based on U. S. Forest Service statistics for 1949, circular mills, well managed to poor—published July 1950.

TABLE 4.—YELLOWPOPLAR CUT AT 58 SAMPLE SAWMILLS IN THE TENNESSEE VALLEY

D.i.b. class	Number logs	Quality index[1]	Volume bd. ft.	Percent of total	Value[2]	Value per Mbf.	Hourly production rate[3]
3.5	1	27.8	9	—	$ .41	$ 45.55	—
5.5	39	33.4	494	0.8	27.08	54.70	430
7.5	107	40.0	2,443	3.7	160.36	65.72	608
9.5	253	46.7	9,067	13.8	694.84	76.61	1,120
11.5	232	51.2	13,119	20.0	1,102.25	84.01	1,240
13.5	156	54.8	12,870	19.6	1,157.36	89.93	1,440
15.5	90	57.8	9,995	15.2	948.02	94.80	1,586
17.5	53	59.9	7,643	11.7	751.28	98.34	1,580
19.5	27	61.6	4,873	7.4	492.59	101.15	1,400
20.5+	21	63.7	5,078	7.8	530.81	104.49	1,515
All	979	—	65,591	100.0	$5,865.00	$ 89.42	1,199

[1]Curved values for all grades.
[2]Using $164.05 per thousand board feet. This is the 1949 average for Firsts and Seconds, published by the U. S. Forest Service, Southern Region, Atlanta, Georgia, July 1950—class of mills: circular, well managed to poor.
[3]Actual headsaw time.

Their cutting is unwarranted from a silvicultural standpoint because they are the most desirable trees on which to base a future crop. It is poor economics to cut them because they are returning the highest interest rate on the landowner's investment; as logs, they do not pay their way through the mill. Leaving them would affect total lumber production very little, production value not at all.

Literature Cited

1. ASHE, W. W. 1913. Yellowpoplar in Tennessee. State Geol. Survey Bull. 10-C, Nashville, Tennessee.
2. AUTEN, JOHN T. 1937. Site requirements of yellowpoplar. Central States For. Exp. Sta. Note 32, Columbus, Ohio.
3. HEIBERG, SVEND O. Cutting based upon economic increment. Jour. Forestry 40:645-651.
4. HERRICK, ALLYN M. 1946. Grade yields and overrun from Indiana hardwood sawlogs. Purdue Univ. Agric. Exp. Sta. Bull. 516, Lafayette, Indiana.
5. JEMISON, GEORGE M. and GEORGE H. HEPTING. 1949. Timber stand improvement in the southern Appalachian region. U. S. Dept. Agric. Misc. Pub. 693, Washington, D. C.
6. LOCKARD, C. R., J. A. PUTNAM, and R. D. CARPENTER. 1950. Log defects in southern hardwoods. U. S. Dept. Agric. Handbook 4, Washington, D. C.
7. MCCARTHY, E. F. 1933. Yellow poplar characteristics, growth, and management. U. S. Dept. Agric. Tech. Bul. 356, Washington, D. C.
8. NATIONAL HARDWOOD LUMBER ASSOC. 1950. Rules for the measurement and inspection of hardwood lumber cypress, veneers and thin lumber. N.H.L.A., Chicago.
9. SOUTHEASTERN FOREST EXPERIMENT STATION. 1948. Tree grades for loblolly and shortleaf pine. Southeastern Forest Exp. Sta. Tech. Note 69, Asheville, N. C.
10. STEER, HENRY B. 1948. Lumber production in the United States 1799-1946. U. S. Dept. Agric. Misc. Pub. 669, Washington, D. C.
11. TENNESSEE VALLEY AUTHORITY. 1942. Forest areas by states and counties and types of ownership. Forestry Bul. 5, Norris, Tenn.
12. U. S. FOREST PRODUCTS LABORATORY. 1949. Hardwood log grades for standard lumber—proposals and results. Forest Products Lab. Report D1737, Madison, Wis.

Forestry School History in Britain

A bit of forestry school history, in Great Britain, may be of interest to readers of the JOURNAL. It was unearthed in the *Contemporary Review* 46(1884)556-563, in an article by Sir John Lubbock, entitled "A National School of Forestry."

Lubbock proposed the establishment of a forestry school in Great Britain by the government or preferably by such existing colleges as Cirencester or Downton, and he recommended that the national forests be made available for use by the forestry students in a manner similar to that of France and Germany. For a faculty he recommended that the authority in charge of Lord Gage's woods be appointed professor of forestry.

Most of the article pertains to the justification of the proposed school. He cites the area of woods and plantations in the British Isles as 2,800,000 acres, all in poor condition, plus an additional 5,000,000 acres in Scotland which should be planted. Colonies and possessions, he reported, had an additional 340,000,000 acres. This was in 1884.

The government was concerned over the decreasing quality of timber on the crown forests for naval purposes. On New Forest for example, he asserts that of 2,635 loads produced "recently" only 936 loads were acceptable to the Navy. Imports were 300,000,000 cubic feet annually at a cost of 15 to 20 million pounds sterling.

Sir John noted that a visiting French forester, M. Boppe, had pointed out, in a nice way, that English methods were archaic, expensive, and obsolete, and that sheep were ruinous to the forest crop during the first and last portions of a rotation period; that there was a lack of effort toward natural regeneration; a tendency to plant in pure stands and the planting of species not adapted to the site.

Due to lack of forestry schools in England, the government has had to send its young men to Nancy in France for training for forestry work in India, while French foresters had to be hired for other English territories even if they spoke no English.

He reported that such writers as Col. Pearson of the India office, Mr. Brown in his work on forestry, Mr. Cruickshank in his *Practical Planter* and Mr. Grigor in his work on arboriculture had continuously called attention to the sad conditions resulting from overcutting, stand depletion, poor planting, and other practices and had urged the establishment of a forestry school. Against this, Sir John pointed to such examples of returns possible from good practices as the French Landes region where a large and worthless area was made to be worth one billion francs in 30 years; India, where the net income from forestry was increased from 52,000 to 215,000 pounds, sterling, in 10 years and a number of European countries that supported forestry schools.

EMANUEL FRITZ.
University of California.

Effect of 2,4-D, 2,4,5-T and Sodium Trichloroacetate on Gallberry

L. K. Halls and G. W. Burton

Respectively, range conservationist, Southeastern Forest Experiment Station; and senior geneticist, Bureau of Plant Industry, Soils, and Agricultural Engineering.

GALLBERRY (*Ilex glabra* L.), an evergreen perennial shrub, occurs extensively in the low pinelands, swamps, and prairies of the Coastal Plain in the Southeastern United States. The plant reproduces by seed and vegetatively by means of extensive creeping rhizomes. This shrub is considered undesirable, as it has very little forage value, and competes with more valuable forage, thereby reducing the grazing value of extensive areas in the Coastal Plain. It acts as a severe obstacle in naval stores operations, but even more important is the extent to which it increases the hazard and intensity of forest fires. Wherever gallberry occurs to any appreciable extent, the fire hazard becomes extremely critical. Green leaves of gallberry have a high kindling temperature and are difficult to ignite but when aflame produce an intense heat which is very damaging to young longleaf (*Pinus palustris* Mill.) and slash pine (*Pinus caribaea* Morelet). Gallberry bushes intercept the annual fall of pine needles, which accumulate on the bushes to form a "draped" fuel that burns very readily. The control or eradication of gallberry, therefore, is one of the critical problems confronting timber producers.

The method of gallberry control generally employed by landowners is periodic burning of critical areas. Burning destroys the top growth for a few months, but resprouting soon furnishes as many or more stems than were originally present (Fig. 1). With burning, gallberry is prevented from attaining maximum height, and the fire hazard is reduced. But the gallberry is not eliminated; it is temporarily controlled, and with subsequent fire protection it again becomes a severe fire hazard.

FIG. 1.—This clump of gallberry had been protected from fire for several years but was burned and killed to ground last winter. Note resprouting and subsequent growth which took place in 10 months.

Successful eradication of gallberry has been accomplished by disking or plowing. Such practices are very difficult or may be impossible where well stocked natural stands of timber occur, and for a vast majority of the area cannot be applied.

The use in recent years of chemicals for control and eradication of numerous herbaceous and woody plants has received considerable interest and many desirable results have been obtained. The use of these herbicides for the control of gallberry has not received extensive investigation but does offer possibilities which may be of great benefit to landowners in the Coastal Plain. The following study,[1] more or less exploratory in nature, was begun in 1948 for the purpose of determining the effect of the more popular chemicals on gallberry.

TABLE 1.—THE EFFECT OF VARIOUS CHEMICALS IN KILLING GALLBERRY

Chemical formulations and concentrations[1]			Percent of gallberry killed[2]
2,4-D	2,4,5-T	T.C.A.	
Gal. per 100 gal. of water	*Gal. per 100 gal. of water*	*Lbs. per 20 gal. of water*	
0	0		0
⅜	0		8.0
½	0		7.5
1	0		8.5
1½	0		14.5
0	⅜		28.0
0	½		91.5
0	1		91.0
0	1½		38.0
¼	¼		69.0
½	¼		40.5
¾	¼		81.5
¼	½		90.5
¾	¾		50.0
		12	

[1]Concentrations are expressed in terms of product as purchased and not acid equivalent.

[2]Least significant difference for treatment comparison at the 5-percent level is 36.2.

Materials and Methods

Chemicals used in the study were as follows: (1) Isopropyl ester of 2,4-D (2,4-Dichlorophenoxyacetic acid) which contained the equivalent of 3.34 pounds of acid per gallon, (2) Isopropyl ester of 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid) which contained the equivalent of 3.34 pounds of acid per gallon, and (3) T.C.A. (Sodium trichloroacetate) acid equivalent 50 percent. Chemicals were mixed with water at the concentrations listed in Table 1. The fifteen treatments were replicated twice on randomly selected plots 50 feet by 50 feet.

[1]Cooperative investigations of the Georgia Coastal Plain Experiment Station, the United States Department of Agriculture through the Forest Service, and Bureaus of Animal Industry and Plant Industry, Soils, and Agricultural Engineering. Acknowledgement is made to J. S. Williams, agronomist, Department of Agronomy, University of Houston, for technical assistance in the development of the study, and to H. A. Nation, representative, Technical Service and Development Division, Dow Chemical Company, for information on spraying techniques and assistance in procurement of chemicals.

Spraying was done with a portable power sprayer at the rate of 175 gallons per acre during the first part of March. The spray was directed at the foliage of the plants.

The experimental area was characterized by an uneven stand of longleaf pine, slash pine, and pond pine (*Pinus serotina* Michx.). The soils, rather poorly drained and of low fertility, were Plummer sand and Lynchburg loamy fine sand. Gallberry was the predominant shrub and had an average foliage density of 40 percent. Herbaceous ground cover was mainly wire grass (*Aristida stricta* Michx.), Curtiss dropseed (*Sporobolus curtissi* (Vasey)Small), carpet grass (*Axonopus affinis*, Chase), bluestems (*Andropogon L.* spp.) and various panicums (*Panicum L.* spp.).

The percent gallberry kill was determined by estimation of foliage density at the start of the experiment and after a lapse of one year (1949). Differences between the original and first-year estimates were attributed to spray effects of chemicals and interpolated as "percent kill." In order to ascertain permanency of kill and degree of resprouting and regrowth, estimates were made two years after chemicals were applied (1950).

Results

The formulations and concentrations of the various chemicals and their effect on gallberry are presented in Table 1. Reference to the table shows that none of the 2,4-D sprays, when used alone, produced a significant kill of gallberry. The 2,4,5-T treatments at the lower concentrations appeared to be more effective than 2,4-D, although significant differences were not obtained until concentrations of 1 gallon per 100 gallons of water were used. At lower concentrations, 2,4,5-T appeared to be more effective when used in combination with 2,4-D, and significant kills of gallberry were obtained at concentrations of ¼ gallon of each to 100 gallons of water. Exceptionally good gallberry kills

FIG. 2.—The effect of chemical sprays on gallberry. The plot to the left of the white marker served as check; plot on right was treated with ½ gal. 2,4,5-T and ¼ gal. 2,4-D per 100 gal. of water. Photo taken two years after application of chemicals.

were not obtained, however, until concentrations of at least ½ gallon of 2,4,5-T, with ¼ gallon of 2,4-D per 100 gallons of water, were used. A concentration of ¾ gallon of both 2,4-D and 2,4,5-T per 100 gallons of water produced about the same results as the concentration of 1 gallon of 2,4,5-T per 100 gallons of water.

At current prices, 2,4,5-T costs approximately two and a half times more than an equivalent amount of 2,4-D. On this cost basis, there would be little difference between the treatments which had 1 gallon of 2,4,5-T or those which had ¾ gallon of 2,4,5-T in combination with ¾ gallon of 2,4-D. However, very good results were obtained when a combination of ½ gallon of 2,4,5-T and ¼ gallon of 2,4-D in 100 gallons of water was used, and the cost of chemicals was about one-half as great. On a cost basis it would seem desirable to apply the two chemicals in combination and at a somewhat comparable concentration to that used in the latter treatment.

T.C.A. produced significant differences in gallberry kill over that of 2,4-D, although no significant differences were noted between this treatment and the lower concentrations of 2,4,5-T alone or in combination with 2,4-D. T.C.A. was significantly less effective than the better treatments of 2,4,5-T.

An average foliage density of all plots showed that gallberry increased about 7 percent, a slight but significant amount, during the second year after treatment. Only a few plots failed to show an increase. The greatest increase in density, during the second year, occurred on those plots which originally showed the least effective kill. Plots on which gallberry was most effectively killed by application of chemicals increased in density only 4 percent during the second year after treatment. At this rate of increase a considerable number of years would pass before gallberry would again become a critical problem.

All chemicals had an effect on pine seedlings, many of which were killed when the sprays were permitted to fall on the needles. The weaker solutions seemed to have as much effect as the more concentrated solutions. T.C.A. was the most harmful, however, and caused needles to turn brown and drop from pines as large as 10 inches d.b.h. Trees as large as 3½ inches d.b.h. were killed by T.C.A. The density of the bunch grasses was reduced about 40 percent by T.C.A., whereas neither 2,4-D nor 2,4,5-T had a noticeable effect at the concentrations used. The chemicals had no harmful effects on cattle that had access to the area throughout the study.

Discussion and Summary

The results indicate that successful kills of gallberry may be obtained with certain selected chemicals, and create possibilities for land management which may be superior to the system most often used in the prevention of disastrous fires. The common practice of periodic burning for reduction of fuel has only a temporary effect. With protection from fire for a few years, gallberry will again attain considerable height, needle-fall will accumulate on branches, and fire hazard conditions become as critical as they were originally. However, the use of chemicals offers possibilities of materially reducing the fire hazard on a more permanent basis. Because the underground root-stocks of gallberry are killed by the action of the chemicals, very little resprouting occurs and new plants are slow to replace those which were killed. Care should be taken in the use of chemicals to make sure that

none of the spray gets on young pine seedlings, which appear to be quite susceptible. If the height of trees is such that little of the spray is permitted to get on the needles, then only minor damage will result.

The greatest obstacles to the use of chemicals at present are the amount of labor involved, equipment required, and cost of the chemicals. Such factors may prohibit the use of chemicals on an extensive basis. However, on certain critical areas having a very heavy infestation of gallberry, such as along fence rows, or around experimental areas and buildings where fire should definitely be avoided, the use of chemicals for eradication may prove practicable.

With increased knowledge of proper technique of spraying, proper concentration of chemicals to use, and the correct time of year to spray, the use of these chemicals can be greatly expanded. At present 2,4,5-T at a concentration of 1 gallon per 100 gallons of water, or a combination of ¾ gallon 2,4,5-T and ¾ gallon of 2,4-D per 100 gallons of water applied at the rate of 175 gallons per acre appears most effective in killing gallberry. Costs of chemicals for these two treatments are approximately the same. However, a combination of ½ gallon 2,4,5-T and ¼ gallon of 2,4-D per 100 gallons of water has given nearly as good results at half the cost.

New Trends in Range Soils[1]

W. G. McGinnies

Director, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

THERE ARE NO NEW TRENDS in range soils, but there are new trends in our thinking on range problems. The idea that partial solution to many problems can be found in the influence of soils upon such things as quantity, quality, and kind of herbage produced; upon soil moisture relationships, erosion and range recovery is expanding rapidly.

Soils, like plants, are in a constant state of change. Soil development involves a series of changes that, in the aggregate, tend to make them more productive. However, at any time these constructive forces can be counteracted by an opposing set of destructive forces that lower the site potential through reduction in fertility and available moisture. The destructive trend is nearly always recognizable by increased surface erosion and gullying. The quantity and quality of herbage growing in a site is related to the up or down trend of the soil at the time. A critical examination of wild lands will show that a high percentage of those deteriorating are rangelands which are grazed, or have been grazed to some degree in the past.

Range management, then, involves three basic characteristics that are an integral part of all soils; namely, fertility, moisture absorption and retention capacity, and inherent erodibility. Under good management, the soil is kept in a healthful state so that its capacity to produce is maintained or increased within the limits of its fertility. Under poor management productivity decreases, less moisture enters the soil, and more water runs off to cause surface and gully erosion. The site deteriorates. Good management results in a sustained yield of forage; poor management results in continuously decreasing yields. A large part of good range management is, in reality, good soil management.

Soil Fertility

Fertility is one of the most desirable characteristics of soils. A soil that does not supply nitrogen, phosphorus, potassium, and minor elements in sufficient quantities and in proper balance to the plants is just as useless for the growing of range herbage as it is for cultivated plants.

Fertilization of soil for cultivated plants has been a standard practice for a long time, but the same fundamental thinking with respect to range soils is not far advanced. Fertilization of range soils, even where needed, is not often feasible. Rather, range managers must work largely with what they have, recognizing that differences exist in the inherent fertility of different soils and that the yields of forage must differ also.

There are three approaches to the determination of soil fertility; namely, laboratory analysis of the soils, field-plot trials, and chemical analysis of the forage. The Rocky Mountain Station has done work on the first two. Since 1946 we have had a series of field plots on seven widely different soils. All soils showed response to nitrogen, and those from granite responded to potassium and phosporus as well.

Laboratory analyses have also been made on a number of soils to determine the readily available nutrients (Table 1).

These data show the very great differences that exist in natural fertility levels. They likewise show that the total capacity to be fertile or to hold nutrients is very different. Soils from granite have long been known to present range problems. They lack the nutrient capacity to respond quickly to good management.

Soil Moisture, Absorption, and Retention

No matter what may be its level of fertility, a soil will not be productive unless moisture is available to the plants. Desirable physical conditions for moisture exist when the soil has a good open granular structure. This type of structure reaches optimum development when the herbage of a range is in good

[1]Paper presented at a meeting of the Division of Range Management, Society of American Foresters, Washington, D. C., December 15, 1950.

TABLE 1.—THE DIFFERENCES IN FERTILITY LEVELS OF THREE RANGE SOILS

Soils developed from	Total capacity to hold nutrients	Readily available nutrients in the soil			
		Ca	Mg	K	P
	Lbs. of Ca per acre	*Lbs. per acre*			
Pikes Peak granite	3,000	2,000	400	400	60
Andesite	7,000	5,000	700	900	120
Morrison shale	13,000	9,000	600	1,500	40

to excellent condition. Under such conditions moisture passes into and is held in the soil rather than being lost from the site as surface runoff. Ability of soils to absorb and hold moisture varies greatly. Sandy, gravelly soils absorb moisture rapidly, but they hold less water in the root zone than do loams and clays. Also, trampling by livestock destroys structure in clays and loams more rapidly than in sandy soils. Early spring use on wet clay sites is especially destructive.

Increased surface runoff is also correlated with the amount of litter on the surface and the intensity of livestock use. For example, in work at the Manitou Experimental Forest, the infiltration rates in pastures having light, moderate, and heavy use were compared with adjacent enclosures that had been protected for 7 years. Average infiltration rates in inches per hour for three grazing intensities were below that on adjacent protected areas by the following amounts:

GRAZING INTENSITY		
Light	Moderate	Heavy
0.76 inch	1.17 inches	1.70 inches

In effect, heavy grazing has reduced water intake by nearly 1 inch per hour in comparison with light grazing. This 1 inch of water could have produced an additional 450 pounds of herbage during the growing season, using the average requirement of 500 pounds of water to produce 1 pound of native herbage.

These data show that appreciable decreases in infiltration are associated with intensity of use. Quantitative values, of course, are conditioned by the soil type and the frequency and amount of rainfall during the growing season. The example is used merely to illustrate the real practical value of a type of range management that favors good soil structure and increased moisture intake.

Inherent Erodibility

It is well known that some soils are relatively resistant to erosion even under poor management, while others melt like sugar. This characteristic is often associated with the kind of parent rocks as well as with the type of management. Those soils that are inherently highly erosive probably eroded some before the white man came but erosion has been greatly aggravated since by his activities. Some are so unstable that good land management requires the exclusion of livestock altogether in the interest of watershed management. The problem in research is to study these differences and to establish comparative values as a guide to use.

Field Applications

Field application of research must take into consideration the different soils, their geographic distribution, and their current state of health. The intensity of field mapping, for example, must be tied to the level of management that can be applied to the land. It is of little value to have a very detailed map of the physical features when the land must be managed in units of thousands of acres. Over the last 5 years we have experimented with many intensities of surveys over both large and small areas. It has been a process of feeling our way. Out of it, we have developed a type of analysis which includes the following points: Geology, land forms and topography, soils, surface erosion potential, and condition of the drainage system.

These physical features have been studied in close combination with range surveys and also independent of them. Methods for arriving at livestock adjustments by combining the herbage inventory and physical analyses using index numbers have been explored with some promise. However, we now think that the over-all land-management needs of rangelands can best be met by conducting physical surveys somewhat independently of herbage surveys.

Potentialities in terms of vegetal growth and the current state of health of range lands are obtained from this type of physical analysis. These are basic data, and from them integrated management plans can be made not only for range, but also for timber and watershed management. They make possible the application of field plot, laboratory, and other research findings to broad areas in the field to which the research applies. It is well known that field conditions vary a great deal and research results often cannot be directly applied, but must be modified to meet local variations in the physical conditions. We plan to extend this type of field research to many other different areas and under various levels of use. Usable standards can be set up for the guidance of ranchers and forest rangers in an analysis of the potentialities and the health of their ranges.

As I indicated at the outset, soils are an important part of range management and should be recognized about equally with herbage management. Range soils cannot at this time be economically rebuilt by plowing, or by the addition of barnyard manure, fertilizer, or green manure crops as can some of the deteriorated agricultural soils. Therefore, in all work with soils that produce herbage, range managers should realize that each soil has its inherent potentialities and limitations.

A recognition of the inseparable relationship between soils and the herbage they produce will help us in solving many complex range problems.

Pine Marten as a Forest Product[1]

William H. Marshall
Division of Entomology and Economic Zoology, Univ. of Minnesota, St. Paul.

ALTHOUGH FORESTERS are primarily custodians and managers of lands and trees, they are also concerned with the utilization of resources other than wood. Most foresters are actively aware of game animals because of the extensive recreational use of game during hunting seasons and the direct influence animals—particularly big game—may have on vegetation. This article brings to the attention of foresters a little known animal, yet one inseparably indentified with the wilderness—the pine marten.

The article explores some of the interesting features of the pine marten as related to history, life-history, and ecology, and discusses possible management measures that could be carried out so that the pine marten will take a positive place in forest management rather than its present passive position. Sources of information are world-wide, and, in particular, represent a development of field research carried out on the Boise National Forest, Idaho and the Flathead National Forest, Montana in 1938-1942 and at the University of Michigan library in 1940-1941.[2]

Distribution

Members of the genus *Martes* are distributed around the world in association with the northern coniferous forests. In Europe the animal is known as the spruce marten, in Asia as the sable, and in North America as the pine marten. Although these are different species, their ecology appears to be so similar that all available information will be used where it appears significant. Three marten—the stone marten in southern Europe, the honey marten in southeastern Asia, and the fisher of North America—are quite different and so will not be discussed.

History

In North America marten were one of the "rough furs" that were ignored as long as the trappers could make fabulous catches of beaver. The story in northern Russia and Siberia was quite different. There in the period 1550-1700 Cossacks from the Black Sea area were commissioned by the czars to forge eastward to the Pacific primarily to obtain sable pelts. Large numbers of these "royal pelts" were obtained by hunting or trapping and by exacting tribute from the native tribes of Siberia. Just as the beaver drew the Voyageurs throughout the western United States and Canada, so the sable attracted the Cossacks through northern Asia (*7*, *6*).

In both continents these animals were very seriously overtrapped and in many regions were nearly exterminated. The overtrapping of marten in North America apparently occurred after the beaver exploitation was finished—some of this exploitation as late as the period between 1900 and 1925. However, as Yeager (*19*) points out, during the past five years the annual catch has run close to 30,000—one-third being in British Columbia, with Alaska and the Northwest Territories averaging considerably less. Ontario, Quebec, and the Yukon have yielded some 1,000 to 2,000 pelts a year. Several western states have given an estimated 200 to 1,000 skins in recent years. Thus we find the marten—even with practically no management—is producing some income. The pre-eminence of British Columbia is undoubtedly due to the trap-line system (*5*) which tailors the catch to the area and may be used to fit the trapper into the economics of his community.

FIG. 1.—Captive marten.

Description

The beauty and grace of the Marten cannot be portrayed by mere statistics. The animal is between 2 and 3 feet in total length, with the tail making up about one-third of its length. It is quite long-legged with fully furred feet having semi-retractable claws. The coloration is dark brown with a varied amount of rich orange marking on the throat and belly. As is shown in Figure 1 the heavy head, with large ears and small eyes is striking. A marten moves across the ground by jumping as a weasel does, although one foot is usually placed in front of the other rather than in opposite pairs as in the weasel.

Cover Use

During much of the year marten tracks are difficult to find. However, they may easily be observed in soft snow, where each footprint is approximately three-fourths of an inch in diameter. The animal often plows through soft fresh snow and may tunnel in snow when approaching prey, or perhaps in play.

Although marten are said to be primarily arboreal, much of their time is spent on the ground. Dur-

[1]Much of the data discussed is extracted from a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, University of Michigan.

[2]The field project was carried on while the author was employed by the U. S. Fish and Wildlife Service. The late Professor H. M. Wight and Dr. H. T. Jackson were of particular help during the study. The cooperation of many U. S. Forest Service, Fish and Wildlife Service, Idaho and Montana game and fish agency personnel was essential to various phases of the field work.

Fig. 2—Stump used as daytime den by marten during previous winter (1939).

ing nine days of tracking two marten over an estimated 17½ miles, neither animal was found to have entered a tree. A third animal was tracked for 21 miles over a six-day period and was found to have climbed trees only eight times. In each case the trees had dense crowns, most frequently having "witches brooms." Marten usually jumped out of these trees, often landing in the snow some 30 to 40 feet from the trunk of the tree. Russian writers report similar habits for the sable.

Cover or timber type preferences of marten give an indication of their relationship to forestry. During the winter months the animals used most intensively the dense Alpine fir. Engelmann spruce, and Douglas-fir stands comprising only 12 percent of the acreage in the Boise study area. Ponderosa pine stands, which made up a third of the area, were entered frequently but usually when adjacent to the fir-spruce stands. In this area the very open pole and protective stands and the grass and brush areas were not used. The use of fir-spruce types allows for a very extensive altitudinal range throughout much of the Rocky Mountains, as the dense stands may exist in pockets on south slopes almost to timberline, and conversely extend well down to lower elevations on north slopes and canyon bottoms. These observations agree closely with comments by Kozhantschikov (*8*) who worked in the Saijan Mountains of central Siberia.

While moving about in timber marten hunt from one snag, windfall, or dense tangled clump of low brush to another often trying to approach such a feature by long leaps from the uphill side. If this "rushing approach" fails to surprise a larger animal such as snowshoe hare or red squirrel, the marten proceeds to search every hole or crevice in detail.

In forested areas marten frequently use down timber or stumps (Fig. 2) for daytime dens. In the Boise study area, of sixteen marten tracked to dens thirteen had used down logs and three holes in stumps. There appeared to be little regularity in the use of dens—the main point being the proximity of a kill.

These details of use of specific pieces of cover are very similar to reports in the literature from Europe and Siberia. They are cited because of their relationship to forestry. Schmidt (*18*) mentions the very intensive use of forest tracts in Germany as being significantly detrimental to spruce marten, since the down timber and debris are cleaned up. Under the extensive logging operations in North America sites highly useful to marten might well be increased.

Marten apparently are less restricted in habitat during the summer months when they have been reported in North America as foraging in open rock slides, brush fields, and meadows, as well as in areas containing stands of timber. Russian observers agree with this conclusion. Interestingly enough Millaise (*13*) reports the spruce marten in northern England has "learned" to live in the heath following extensive deforestation.

Cruising Radius

The extent of movements of the individual marten is of prime im-

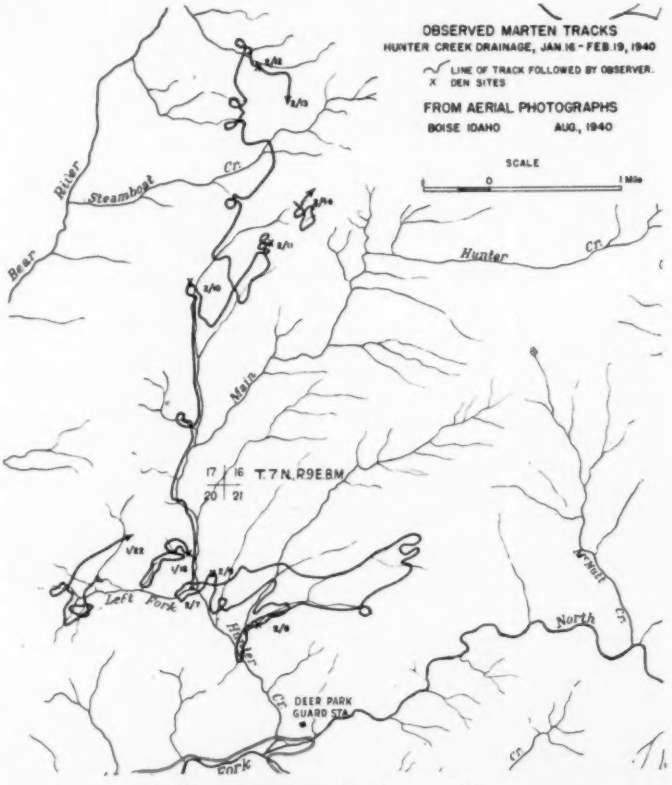


FIG. 3.—Track records of one marten.

portance in considering the control of trapping operations. Data on this point should be worked out by intensive live trapping, tagging, and retrapping techniques which the author did not use in the field. In the Boise study information on this point was obtained by means of tracking in fresh snow.

Figure 3 shows track records for what is believed to be one marten over a period of nearly a month in January and February of 1940. Table 1 indicates the number of miles tracked and the estimated area over which the animal moved on days when perfect and complete tracking records were obtained. Similar patterns were observed in other areas where less complete data were possible. Apparently the animals do a great deal of moving about —crossing and criss-crossing their own tracks—in a relatively small area containing a favored series of covers. The availability of food is probably the most important factor affecting daily range. For instance, one animal was known to have remained on a quarter-section for four days and nights while feeding on the meat of an elk carcass cached by poachers. Other factors which may play a part are snow conditions and the physiological condition of the animal.

TABLE 1.—MARTEN MOVEMENTS, HUNTER CREEK

Date (1940)	Estimated distance miles	Estimated area square miles
Jan. 16	8	¾
Feb. 8	4	1¼
Feb. 9	2	½
Feb. 10	5	¾
Feb. 11	3½	½
Feb. 12	9	2

When considering movements of one animal during the entire winter season, it appears that it moves over a 10 to 15 mile square area, covering certain portions intensively night by night and returning to favored spots for hunting at intervals of two to three weeks.

The observations are in close agreement with those of four Russian authors who have worked with sable in Siberia. Dulkeit (*4*) describes a "hunting plot" (seasonal range) divided into "hunting sections" (daily range) from 2 to 9 square miles and 0.6 square mile in size, respectively. Kozhantschikov (*8*) describes individual ranges of sables as varying from slightly less than a mile in area to over 4 square miles, depending primarily on the food supply. Malaise (*9*) states: "The range of individual animals was confined to two or three wooded mountain ridges, the headwaters of two or three neighboring streams, in all a space of nine to eleven square miles."

Marten apparently travel alone during the winter months although several animals can and do use a favorable area simultaneously which may be the basis for the reports of trappers that marten travel in groups. During two winters of almost continuous tracking in the Boise area no case of marten traveling other than alone was recorded. During the winter of 1941-42, 183 records of marten tracks were made in the Flathead Forest, Montana. In 29 cases two animals, in 5 cases three, in 2 four, and in 1 six animals had probably traveled together. In the other 146 cases only one animal was present.

The marten is very flexible as to the time of day or night it moves about. He is most active in early morning and evening. Kozhantschikov (*8*) reports both a day and night rest period with hunting in the interim. Schmidt (*17*), after working with several hundred captive sable and spruce marten, reports similar activity patterns affected to a considerable degree by light and temperature so that on dark and/or moist days the animals were often active all day.

Foods

Food habits of marten are very generalized and probably reflect relative abundance of a wide variety of small mammals and birds as well as of fruits and nuts.

On the Boise study area, winter tracking showed that marten caught snowshoe hare, pine squirrel, flying squirrels, and nut-hatches. They were known to eat elk meat, mountain ash berries, and chokecherries. Analyses of 34 stomachs and scats from the same area showed the animals had also taken shrews, white-footed mice, red-back mice, and meadow mice. Of these the flying squirrel and snowshoe hare were most comonly taken. Traces of blue grouse and a small passerine bird as well as grass and coniferous needles and seed wings were found.

Winter food habits data for such areas as western Montana (*10*), central Alberta (*3*), Kamchatka (*9*), Shantar Islands (*4*),central Siberia (*8*), and the Ural Mountains (*16*) also indicate the major importance of small rodents, certain berries or fruits, and pine nuts.

An even wider choice of foods is pointed out by various authors for other periods of the year, when nestling birds, fruits and berries, pine nuts, and some insects have been reported.

Examination of these data discloses that the widely accepted concept of a direct relationship between marten and red squirrels is overemphasized. It is of interest that Newsom (*14*) reports marten as having been abundant on Anticosti Island in the Gulf of St. Lawrence, where there were no red squirrels.

Another broad inference that may be made is that the bulk of data on marten food habits clearly shows that they depend primarily on small non-game animals and on various nuts and berries.

Breeding

Marten are polygamous and sex-ratios in the wild are apparently evenly divided. Examination of 124 marten carcasses from central Idaho showed 63 males and 61 females. Yeager (*19*) reports a similar ratio from much more extensive data.

The breeding season of marten is established as occuring in July and August. This was first announced by Ashbrook and Hanson (*2*) and fully confirmed by Schmidt (*17*) who cites that of 140 matings 9 were in June, 129 in July, and 2 in August.

By far the greatest number of births occur in early April. This determines the gestation period as between 8 and 10 months. Schmidt (*17*) reports that 65 percent of 52 known gestation periods were between 270 and 285 days.

The lengthy gestation period is based on a phenomenon known as delayed implantation. Blastocysts of approximately 300 to 500 cells lie relatively inactive in the uterine horns from at least October to mid-January (*12*). Near the later date they became implanted in the walls of the uterus and develop to full term young by early April.

As shown by 12 scattered records in literature and 9 corpora lutea counts in wild caught marten from Idaho, the common number of young per litter is three. Schmidt's data (*18*) on 264 spruce marten, and 108 sable litters born in captivity corroborates this statement.

The age-class distribution of a marten population is of greater significance. Evidence from captive spruce marten and sable in Europe (*18*) and pine marten in Idaho and Montana (*11*) shows the females do not mate until their second summer and hence do not bear young until their third year of life. Adult female marten apparently breed each year under wild conditions.

The combination of a two-year lag before production of young and small litter size means that marten populations are slow in building up or in recovering from over-utilization.

The time of pelt primeness is important in considering fur-animal management. An unprime fur is practically worthless as both its appearance and quality are poor. Although quantitative data are lacking on this point, information available indicates that the animals do not "prime out" until late in October (*18*).

Decimating factors

The limiting factor of marten for the past century has undoubtedly been trapping. Marten apparently have never developed a fear of such structures as the steel trap. According to Schmidt (*18*) this still holds true for spruce marten in central Europe after several centuries of hunting and trapping by various means. Actually Idaho trappers deliberately make their sets obvious in order to attract the animal's attention and arouse his curiosity (Figs. 4 and 5).

FIG. 4.—Trap set Douglas-fir stand, Boise National Forest.

Fig. 5.—Trap set lodgepole pine stand. Boise National Forest.

The trapper's chief difficulty lies in the inaccessability of areas where marten range. The highest catches of marten in Idaho in the years 1940 and 1942 were in areas remote from roads and particularly in areas known for frequent snow slides. Since winter movements of marten are relatively restricted there will nearly always be small areas in very rough country that cannot be trapped out. Another practical point in this connection is that control of shelters—cabins or ranger stations—usually means control of trapping operations.

Poisoning operations for certain predators may well have caused serious losses of marten in the past. The writer was reliably informed that four dead marten had been picked up at a poison station on the Boise Forest in 1924. Programs for control of predators are more closely supervised now than in the past and are predicated on a policy of not using poison in timbered areas. In addition, the "studding" or poisoning of entire carcasses is generally avoided. Where these two points are followed, the danger is probably small. The Russians (*4*, *16*) report that big-game carcasses are deliberately placed on stands so as to provide winter food for sables in Siberia, and the use by marten of cached elk meat in Idaho indicates that marten will take such meat during the winter.

Evidence of predation on marten is very limited. None was found during the Idaho studies. Scattered reports from other studies indicate coyote, fisher, golden eagles, great horned owls, and cougars may prey on marten, but it is doubtful whether this is a steady drain on populations. Dulkeit (*4*) states that adult male sables may prey on very young marten and he believes this predation is important in regulating numbers.

Although numerous records of parasitism in marten exist, there is little information as to the pathogenicity of the organisms.

Competition for food is undoubtedly an important factor during the late winter months. The long-tailed weasel was known to compete directly for flying squirrels and mice in the Boise study area (*15*), while coyotes and goshawks took snowshoe hares in the same covers where marten hunted. The best information available on this point comes from the Shanter Island of eastern Siberia (*4*). There it was estimated that two thousand ermine consumed food sufficient for five hundred sables and that owls and foxes were of some importance. The significance of competition was not assessed. Presumably the

weasel might well compete successfully for small mammals and be of significance if in very high numbers.

The reduction of habitat by man though extensive cutting of mature pine forests, followed by uncontrolled fires, may have been an important influence over large areas in the past. However, operations as now conducted may be largely favorable from several aspects. Thus relatively small cuttings with the attendant slash could be beneficial to small rodents and hence to marten food supplies. In northern areas protection from fire tends to increase growth of climax conifers—stands favored by marten. As mentioned previously, intensive utilization of wood in German forests has been cited as detrimental.

Grazing, in general, is not carried on intensively in spruce and fir stands but overbrowsing by game animals may well affect berry supplies. Thus on the Boise Forest in 1940, elk heavily used mountain ash in an area occupied by at least one marten which also frequently used these berries.

Special uses such as gold dredging, park recreational development, and roads may well eliminate small areas in mountainous country, but are unlikely to affect a large percentage of the area in either the western forests or northern coniferous areas.

Two salient points explain the present low populations of marten in much of North America: first, the ease of catching marten in steel traps; and second, the very low reproductive potential of the species. Thus, accessible areas may be quickly overtrapped and then it will take years for the population to recover. Further, since the pelt of a marten has generally been of considerable value many people have found it profitable to trap at every marten track in an area—in this way keeping numbers at very low level.

Numbers

Population density figures were difficult to obtain for pine marten. Based on detailed knowledge of certain trapper's activities, the writer believes that a density of one animal per section was present in three areas of the Boise Forest in 1940. These areas had not been trapped for several years and the figures may represent high population levels. On accessible areas of the same forest it is believed there were not more than one animal per twenty sections.

Fig. 6.—Johnson Creek drainage, Boise National Forest, 1938.

Production

The trapping record of Albert Duchaynai of the Boise Forest from 1931 to 1940 is of interest. During this period, Duchaynai trapped an area of approximately 60 square miles in and around Johnson Creek (Fig. 6). However because of his age his range of trapping dropped off greatly after 1936. His catch as reported is as follows:

Year	Number	Year	Number
1931	29	1936	19
1932	48	1937	19
1933	30	1938	18
1934	20	1939	15
1935	28	1940	11

It is probable that the area could have maintained a production of thirty animals per year—or one per two sections. On the basis of an average price of $20 per pelt the annual economic yield was ten dollars per section.

For the Boise Forest as a whole, 222 marten were known to have been taken by fifteen trappers in 1940-41 (Fig. 7). The total income from these furs was estimated at slightly over $3,600. Not all the trappers gave exact dollar returns but their catches ranged in number from 1 to 57, and in known value, from $22.75 to $489. One man obtained at least $1,200 for his catch.

A study of trapper reports in 1939-40 and 1940-41 for all of Idaho indicated there were about 200 marten trappers in the state and it was estimated that they took about 1,500 marten. The bulk of the trapping was in the northern and central mountainous portions of the state—chiefly national forest areas. Nearly half the 121 trappers reporting caught less than three marten and their trapping income from all firs averaged $120. Nearly half caught from four to sixteen animals with an income of just over $200. Only one-tenth caught over sixteen marten and their income averaged $550.

Knowledge of the Boise Forest trappers revealed the reasons for this variation. The men with low catches were "chance" trappers who operate traps only when a marten track appears near their ranch, logging camp, or mine. The middle group were men who had other incomes during the year but who trapped in the winters. Finally there were a few men who had no other source of income and penetrated the most inaccessible areas for larger catches.

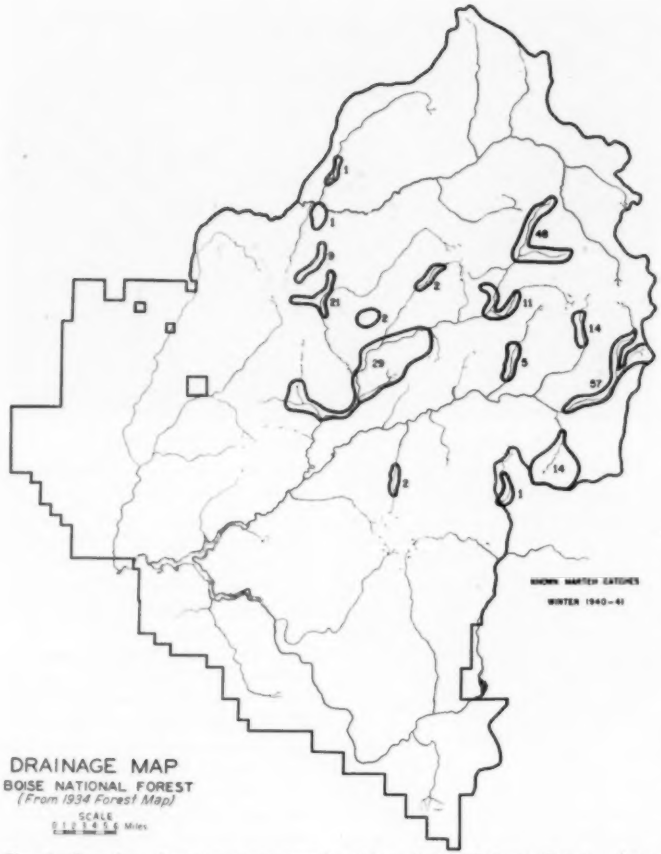


FIG. 7.—Location of marten trappers and catches, Boise National Forest, winter 1940-41.

The two latter groups of trappers were probably cropping their areas at a reasonable rate as they were widely separated and usually had established traplines (Fig. 7). On the other hand the "chance" trappers were over-utilizing large forest areas and retarding any possibility of real recovery of marten numbers over broad areas.

Judging from Yeager's survey of trapping returns (*19*) a similar situation must now exist over large parts of the coniferous forest region in North America. Only British Columbia shows a real return and sustained yield of marten. This is undoubtably due to the "registered trap line" system which, while it guarantees a trapper sole rights to trap an area, also requires him to handle his cropping on a continuing basis. The system has recently spread widely throughout Canada. Idaho placed a law on the statutes in 1941 which in essence allowed for registered trap lines for beaver in that state. This allows the Fish and Game Commission to designate "trapline areas" and appoint a caretaker for them. The caretaker may "take beaver only at such times and places as may be prescribed in writing" and shall have "power to make arrests for game law violations" and shall "protect all other fur bearers in accordance with the law." He must "post a $500 bond," and "receives not more than 75 percent of proceeds of public scale of beaver pelts." Wyoming (*1*) has a similar system on certain national forests where they issue "fur bearing animal trapping permits."

Thus the beginnings of the system which allows for cropping of fur on a basis of "sustained yield" for specific areas has been made. Its success will, in the writer's opinion, be based on one major move—that of integrating winter trapping with seasonal forest employment during the remainder of the year. If the two can be put together—i.e., a lookout-man during the summer, trapping the same area in the winter; or a guide or packer during the summer and fall and trapper in the winter, there is a real possibility of stabilizing and raising the income of forest users with little investment in capital.

There are two aspects to this problem that must be solved before such a program can be carried out.

First, cooperation of agencies responsible for the administration of forested areas—the various state forestry departments and the U. S. Forest Service—with state game commissions, who are responsible for regulations govering the utilization or trapping of marten. The forester who hires temporary personnel can well afford to encourage men who would remain in the area on a year-around basis—it will stabilize his recruitment program by increasing income during layoff periods. The state game department should devise ways and means to stabilize the trapping by areas on a sustained yield basis for these same individuals as it will mean a steady economic contribution by a natural resource for which the state departments are responsible.

Second, a more effective control of the itinerant fur buyer is necessary. This man is the key to evasion of regulations by trappers. If he can move into an area and persuade trappers to over-crop fur animals in spite of regulations, any sustained yield program will fail. Such control is admittedly difficult to obtain and involves further effort by the state game departments and U. S. Fish and Wildlife Service. A "trapline"

system which assures a trapper an area for sustained yield harvesting plus a seasonal employment system, which in a sense guarantees him a living during the rest of the year, is one of the surest ways to combat illegal fur buying. Based on these assumptions and the ecological information cited above, the following steps could well be taken to initiate marten management in a forested area:

(1) Encouragement of individuals to trap and work in seasonal employment in the same area by integrating the temporary employment program with registered traplines.

(2) Assuring trappers of opportunities for steady trapping on registered traplines as long as the area is not overtrapped.

(3) Removal of all unauthorized cabins and control of use of other cabins during the winter months, and constant guarding against illegal fur buying.

Literature Cited

1. ANONYMOUS. Wyoming's fur bearers. Wyo. Wildlife XIV (10): 22-27.
2. ASHBROOK, F. G. and K. B. HANSON. 1930. The normal breeding season and gestation period of martens. U. S. Dept. Agric. Circ. 107: 1-6.
3. COWAN, I. McT. and R. H. McKAY. 1950. Food habits of the marten (*Martes Americanus*) in the Rocky Mountain region of Canada. Canadian Field-Naturalist 64(3):100-104.
4. DULKEIT, G. 1929. Biologie und gewerbejagd des zobels auf den Schantarskii-Iseln. Bull. Pacific Fishery Res. Sta. Vol. 3 (3): 1-119.
5. EKLUND, C. R. 1946. Fur resources management in British Columbia. Jour. Wildlife Mgt. 10 (1): 29-33.
6. FISHER, R. H. 1943. The Russian fur trade, 1550-1700. Univ. Calif. Pub. History XXXI: XI.
7. KERNER, R. J. 1942. The urge to the sea. Univ. Calif. Press., Berkeley.
8. KOZHANTSCHIKOV, I. 1930. Ein beitrag zur kenntnis der Okologie, Biologie, und Georgraphie des Zobels, (*Martes zibellina* L.). Zeitschr. Wiss. Biol., Abt A, Morph. U. Okol. Tierre.
9. MALAISE, R. 1929. Biedrag till kannedomen om kamchatka—sobeln biologie. Fauna och Flora, Arg. 24: 216-221.
10. MARSHALL, W. H. 1946. Winter food habits of the pine marten in Montana. Jour. Mammal. 27 (1): 83-84.
11. ————. 1951. An age determination method for marten. Jour. Wildlife Mgt. (in press).
12. ————and R. K. ENDERS. 1942. The Blastocyst of the Marten (*Martes*). The Anat. Record 84 (9): 307-310.
13. MILLAISE, J. G. 1905. Mammals of Great Britain and Ireland. Longmans Green & Co. London. 3 Vols.
14. NEWSOM, W. W. 1937. Mammals on Anticosti Island. Jour. Mammal., 18 (4): 435-442.
15. RABB, J. C. 1939. A winter study of the daily range and cover type preferences of the weasel (*Mustela frenata nevadensis* Hall). Utah State Agric. College, Logan. (Unpub. Thesis).
16. RAEVSKY, V. U. 1938. On the food composition of the sable (*Martes zibellina* L.) Zool. Jour., Moscow, 17 (2): 337-341.
17. SCHMIDT, F. 1934. Ueber die fortpflangzungsbiologie von Sibirischen zobel (*Martes zibellina* L.) und Europaischen baum marders (*Martes martes* L.) Zeitschr. fur saugetierk, 9: 392-403.
18. ————. 1942. Naturgeschichte des baum-und des steinmarders. Mono. Der Wildsaugeterre. Band X: 1-258.
19. YEAGER, L. E. 1950. Implications of some harvest and habitat factors in pine marten management. Trans, 15th North Amer. Wildlife Conf. 319-334.

Displaced European Foresters Seek Work in U. S.

During the past three years many European foresters and forest workers have arrived in the United States under the Displaced Persons Act. Some are graduates of European schools of forestry with experience in afforestation, operation of tree nurseries, and research. Many have the European equivalent of the bachelor of science and master of science degrees.

In addition to those with professional training, there are numerous skilled forest and mill workers, especially with experience in the lumber industry. Half are said to be experienced surveyors and topographical draftsmen.

Efforts by these men to find employment in American forestry have been disappointing, and many are now working as farm hands, laborers, and porters. Their ages range from 30 to 55. Most are married and 75 percent are said to know English.

Readers of the JOURNAL who may know of employment opportunities are urged to keep these displaced persons in mind.

Information concerning these foresters may be obtained from Nicholas B. Luczakowsky, 923 North Franklin Street, Philadelphia 23, Pa. Mr. Luczakowsky himself is a former instructor in forestry in the Ukrainian Polytechnical Institute.

The executive office of the Society of American Foresters has the names and addresses of other European foresters now in America who are available for employment.

Effect of Grazing on Floristic Composition and Soil Properties of Farm Woodlands in Southern Wisconsin[1]

E. C. Steinbrenner
Assistant in soils, University of Wisconsin, Madison.

OF THE 614 MILLION ACRES of forest land in the United States, 184 million or 30 percent are in farm woodlands. These areas carry nearly 245 billion board feet, or 15 percent of the nation's supply of saw timber (*8*). In addition to being an important source of forest products, farm woodlands moderate floods, retard erosion, provide food and shelter for wildlife, and enhance the value of the farmstead. Although most of the farm woodlands are in various stages of decadence, their importance in the national economy cannot be underestimated.

The productive capacity of farm woodlands depends, first of all, upon their protection from fire, diseases, destructive insects, and grazing (*16*). In the central hardwood region, grazing is the most destructive factor which induces both obvious and concealed deterioration of woodlands. The obvious deterioration is largely confined to mechanical injury of growing stock and destruction of the protective surface layer of humus (*7*). The concealed deterioration affects the physical and chemical properties of the soil (*5, 10*).

This study aimed to express the effects of grazing in terms of concrete analytical data. Investigations were conducted in six pairs of adjacent grazed and ungrazed farm woodlots, selected from important soil-forest units of southern Wisconsin. Each woodlot pair had the same soil type, gradient, and exposure. Originally, the grazed and ungrazed areas had similar forest cover. During the past forty years, however, the density of some stands was modified by grazing and partial cuttings. A brief description of the forest types and soils of the investigated areas follows:

Champion Valley timber harvest forest (Driftless area of southwestern Wisconsin).—Hard maple with some basswood, red oak, and American elm, 120 years old, on nut-structured soil derived from loess (Dubuque silt loam).

Borton farm woodland (Driftless area of southwestern Wisconsin).—Hard maple with some basswood, red oak, and American elm, 130 years old, on nut-structured soil derived from loess (Dubuque silt loam).

Kettle Moraine Forest (Calcareous drift in southeastern Wisconsin).—Hard maple, basswood, white oak, and red oak, 120 years old, on coarse morainic deposits of limestone origin (Rodman loam).

Sheboygan woodland (Calcareous drift in southeastern Wisconsin).—Red oak, 120 years old, on heavy and stony calcareous soil capped with a mantle of loess (Bellefontaine silt loam).

Spring Grove woodland (Unglaciated area of southern Wisconsin).—Hard maple with some basswood, red oak, and American elm, from 120 to 200 years old, on prairie-like nut-structured soil (*18*) underlain by limestone (Downs silt loam).

Albany woodland (Border of the unglaciated area of southern Wisconsin).—White oak, red oak, and butternut, 110 years old, on heavy soil derived from residual limestone overlain by loess (Knox silt loam).

In each grazed and ungrazed woodlot, the frequency of occurrence of ground cover vegetation and natural reproduction was determined on twenty quadrats, one square meter in size.

The frequencies of the important ground cover species for four study areas are reported in Table 1. The results revealed that the indigenous forest species on the grazed areas were partially replaced by invading pioneer vegetation. The sums of frequencies (*12*) of the indigenous and invading species are presented in Figure 1.

Sample trees were selected by the "random pairs" method (*6*), and a complete record of all natural reproduction up to 4 inches in diameter was made on a meter wide strip between each random tree pair. The results, summarized in Table 2, indicate that grazing has reduced reproduction largely in the 3- to 6-foot size class. The density of saplings from 1 to 4 inches in diameter reflects both the intensity and duration of grazing on the area. Because of heavy precipitation throughout the growing season of 1950 and a heavy seed crop, a large population of 2- to 3-month old seedlings of American elm and hard maple was found on both the grazed and ungrazed areas. The ungrazed woodlots showed an abundance of natural reproduction of all size classes.

Soil moisture content on the woodlot pairs was determined *in situ* by the use of gypsum blocks and a modified Wheatstone bridge (*4*). The blocks were inserted in the soil at depths of 4, 12, 18, 24, 36, and 48 inches. The block resistances were measured at bi-weekly intervals throughout the growing season. The results are presented graphically in Figures 2 and 3.

Because of the interaction of many variables (type of forest cover, its density, exposure and gradient, permeability of the soil, its water-holding capacity, and nature of the substratum), each woodlot pair exhibits a different pattern of soil moisture distribution. In general, the highly compacted soils of the heavily grazed woodlots had a lower initial moisture content in the spring and dried out faster in the summer and late fall, evidently because of the lowered soil permeability and increased run-off. The lightly grazed areas with reasonably permeable soils showed a higher moisture content than the ungrazed areas. This

[1]This research was carried on with the support of the Wisconsin Conservation Department, Madison. Publication is approved by the director of the Wisconsin Agricultural Experiment Station. The writer wishes to acknowledge the helpful suggestions tendered by Drs. S. A. Wilde, C. T. Curtis, and C. B. Tanner. Gratitude is expressed to Messrs. F. G. Wilson and A. J. DeVriend, Wisconsin Conservation Department, for their interest and wholehearted cooperation in this study.

TABLE 1.—FREQUENCY OF OCCURRENCE (PERCENT) OF GROUND COVER VEGETATION IN GRAZED AND UNGRAZED FARM WOODLANDS IN SOUTHERN WISCONSIN

Species	Champion Valley Forest		Kettle Moraine Forest		Spring Grove Woodland		Albany Woodland	
	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Adiantum pedatum	15	10	—	—	5	—	—	—
Ambrosia artemisiifolia[1]	—	10	—	5	—	—	—	20
Aralia racemosa	15	5	5	—	—	—	—	—
Arisaema triphyllum	5	—	—	—	5	—	10	—
Aster sagittifolius	—	20	55	5	15	—	30	—
Brachyelytrum erectum	5	10	20	—	—	—	5	—
Caulophyllum thalictroides	—	—	15	—	5	—	—	—
Desmodium acuminuatum	5	—	15	—	—	—	45	—
Dryopteris spinulosa	25	5	—	—	20	—	—	—
Erigeron philadelphicus[1]	—	15	—	—	—	10	—	10
Galium concinnum	5	25	15	—	20	—	70	—
Geranium maculatum	—	—	35	10	15	20	55	5
Hepatica acutiloba	15	5	55	10	15	—	—	—
Osmorhiza Claytoni	25	10	20	5	10	—	20	—
Oxalis corniculata[1]	—	5	—	20	—	30	—	35
Parthenocissus vitacea	—	5	—	—	65	—	100	15
Plantago spp.[1]	—	10	—	—	—	35	—	20
Poa pratensis[1]	10	60	50	25	5	85	75	100
Podophyllum peltatum	10	5	—	—	20	—	20	—
Polygonatum commutatum	5	—	10	—	—	—	5	—
Sanguinaria canadensis	15	5	—	—	35	—	—	—
Sanicula gregaria	5	10	20	—	10	—	45	—
Smilacina racemosa	10	—	5	—	75	—	50	—
Smilax ecirrhata	—	—	5	10	10	—	35	—
Taraxacum officinale[1]	—	30	—	5	—	35	5	80
Thalictrum dioicum	—	—	20	—	—	—	—	—
Trifolium spp.[1]	—	5	—	—	—	5	—	45
Trillium grandiflorum	—	—	35	20	—	5	—	—
Uvularia grandiflora	35	—	15	10	5	—	20	—

[1] Invading species.

TABLE 2.—NUMBER OF SEEDLINGS AND SAPLINGS OF DIFFERENT SPECIES PER ACRE IN UNGRAZED AND GRAZED FARM WOODLANDS IN SOUTHERN WISCONSIN

Woodlot	Species	Size class: 0 to 3 ft. (height)		3 to 6 ft. (height)		1-4 inch (d.b.h.)	
		Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Champion Valley Forest	Hard maple	10,480	571	980	27	207	190
	Basswood	0	897	26	54	180	85
	Elm	0	598	298	85	310	85
	Hickory	47	353	207	0	52	109
	Total	10,557	2,419	1,511	166	649	469
Borton Farm Woodland	Hard maple	11,780	6,930	1,550	0	240	0
	Basswood	268	1,150	560	0	214	90
	Elm	908	136	695	0	214	0
	Hickory	1,150	473	800	315	107	0
	Total	14,106	8,689	3,605	315	775	90
Kettle Moraine Forest	Hard maple	932	46	311	46	976	1,020
	Basswood	377	0	266	0	311	23
	Elm	244	46	133	0	155	185
	Oak	178	23	0	0	0	23
	Total	1,731	115	710	46	1,442	1,251
Sheboygan Woodland	Red oak	0	374	0	0	26	0
	Hard maple	4,010	337	554	0	580	37
	Elm	1,210	262	53	0	53	74
	Black cherry	212	37	132	0	0	0
	Total	5,432	1,010	739	0	659	111
Spring Grove Woodland	Hard maple	2,530	3,200	1,220	0	586	0
	Basswood	0	40	0	0	47	0
	Elm	140	1,809	0	0	164	0
	Oak	23	0	0	0	0	0
	Total	2,693	5,049	1,220	0	797	0
Albany Woodland	Red oak	193	22	24	0	0	0
	Butternut	0	22	0	0	72	0
	Hickory	24	0	24	0	24	0
	Elm	145	196	362	0	411	0
	Total	362	240	410	0	507	0

was apparently because of the increased loss of soil moisture due to transpiration and interception of rainfall by the dense forest cover on the ungrazed areas.

For the determination of water permeability, pore space distribution, and aggregation, 3-inch cores of undisturbed soil were collected by means of a specially constructed soil sampler (*14*). The soil water permeabilities in cubic centimeters per minute were computed by Darcy's law. The samples were then placed on a tension table (*9*) and drained at tensions equivalent to 1, 5, 10, 25, and 50 centimeters of water. The pore diameters were computed by the height of capillary-rise equation (*3*).

For aggregate analysis, the soil cores were crushed and the soil passed through 4- and 20-mesh sieves. That fraction which failed to pass a 20-mesh sieve was used for the determination of water stable aggregates by the Yoder wet sieving method (*19*). Since these samples were subjected to leaching and tension and then oven-dried, the results have only comparative value (*1*).

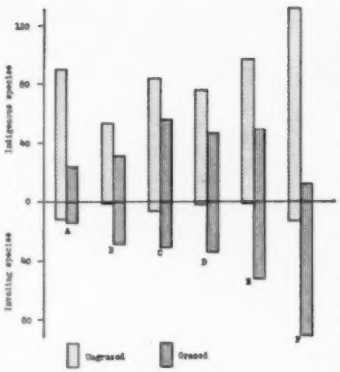


FIG. 1.—Sums of frequency of species on twenty square-meter quadrats in each grazed and ungrazed woodland: *A.*—Kettle Moraine Forest; *B.*—Sheboygan woodland; *C.*—Borton woodland; *D.*—Champion Valley forest; *E.*—Spring Grove woodland; *F.*—Albany woodland.

The degree of air permeability of soils to a depth of 2 inches was determined by use of a sphygmomanometric unit (*17*). The results of the physical analyses are summarized in Table 3.

The water permeabilities reflect the degree of compaction of the grazed soils. This effect is due to the destruction of the soil structure either by trampling or the action of raindrops. The most extreme case of compaction was encountered on the Spring Grove woodlot where the soil of the ungrazed area showed a permeability approximately 245 times greater than the soil of the grazed portion. The least difference was observed on the Champion Valley forest where the ungrazed woodlot had a permeability only 3.3 times as great as the grazed tract.

With the exception of the Borton woodlot, the ungrazed soils showed a higher content of water stable aggregates larger than 0.5 mm. in diameter than did the grazed areas.

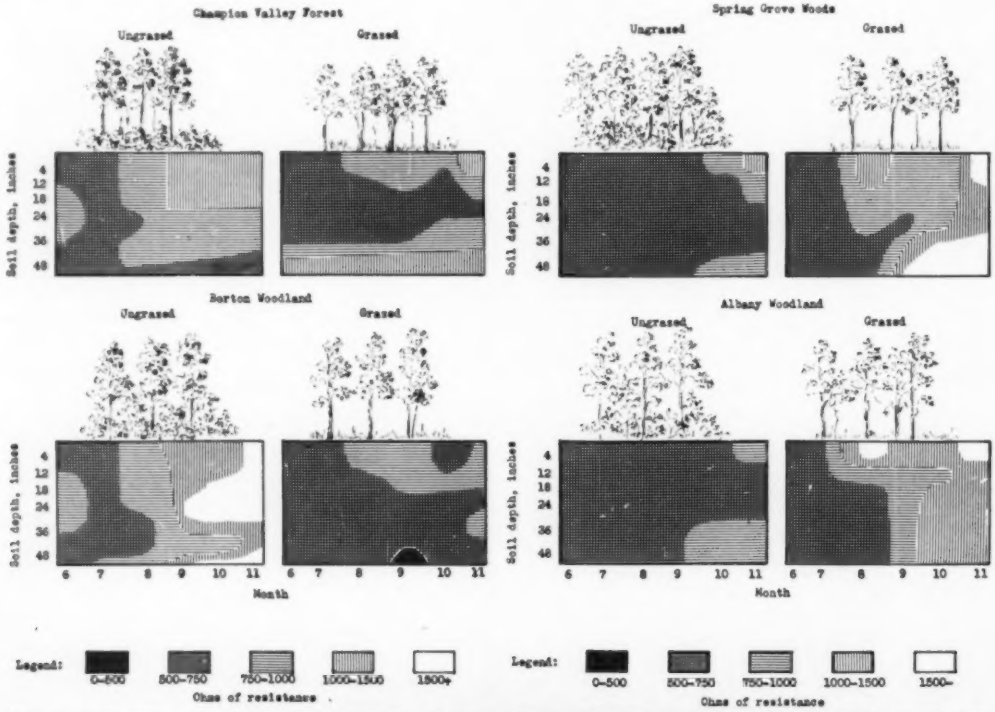


FIG. 2.—Distribution of moisture in loessial soils of farm woodlands in southwestern Wisconsin.

FIG. 3.—Distribution of moisture in loessial soils of farm woodlands in southern Wisconsin.

TABLE 3.—AIR PERMEABILITY, WATER PERMEABILITY, AGGREGATION, AND POROSITY OF SOILS FROM GRAZED AND UNGRAZED FARM WOODLANDS IN SOUTHERN WISCONSIN

Woodland	Air permeability *mm. of mercury*		Water permeability *cc. of water per minute*		Pore space distribution: Total pore space by volume *Percent*		Pore space distribution: Macroscopic pore space > 660 microns *Percent*		Pore space distribution: Microscopic pore space < 660 microns *Percent*		Water stable aggregate > 0.5 mm. *Percent*	
	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Champion Valley	9.6	43.0	1,238	372	64.5	62.0	16.5	17.0	48.0	45.0	53.8	36.0
Borton	8.7	38.0	925	24	70.0	67.0	24.5	17.0	45.5	50.0	61.6	62.8
Kettle Moraine	5.4	44.7	1,545	265	65.5	63.0	26.0	16.0	39.5	47.0	79.3	69.3
Sheboygan	4.6	24.7	955	280	64.5	64.0	21.5	16.5	43.0	47.5	77.6	76.7
Albany	20.0	71.3	2,100	20	67.5	60.0	37.0	12.5	30.5	47.5	73.0	63.3
Spring Grove	24.7	80.7	1,715	7	72.5	57.5	31.0	18.0	41.5	39.5	73.8	64.3

TABLE 4.—REACTION, CONTENT OF ORGANIC MATTER, AND CONTENT OF AVAILABLE NUTRIENTS IN THE 3-INCH SURFACE LAYER OF SOILS FROM UNGRAZED AND GRAZED FARM WOODLANDS IN SOUTHERN WISCONSIN

Woodland	Reaction *pH*		Organic matter *Percent*		Available P *lbs. per acre*		Available K *lbs. per acre*		Replaceable Ca *m.e. per 100 g.*		Replaceable Mg *m.e. per 100 g.*	
	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed	Grazed
Champion Valley	5.98	6.67	8.12	7.14	90	100	305	265	16.1	17.2	2.9	2.8
Borton	6.98	6.84	9.46	7.46	48	44	245	200	27.4	19.0	3.8	2.8
Kettle Moraine	6.45	6.26	9.94	9.39	84	152	245	210	26.0	29.1	8.0	7.1
Sheboygan	6.40	6.34	11.48	9.14	92	240	280	230	14.9	23.0	4.1	5.1
Albany	5.81	6.62	5.99	5.44	54	68	305	240	11.1	16.1	3.1	5.2
Spring Grove	6.55	6.34	8.98	8.76	36	52	265	215	17.9	17.3	4.9	4.3
L.S.D. (.05)			0.41		19.25		18.83					
L.S.D. (.01)			0.54		27.38		26.78					

The soil porosity, computed on a volume weight basis, was in all instances greater in the ungrazed woodlots. The distribution of macroscopic pores, having a diameter greater than 660 microns, shows statistically significant differences. The soil of the Champion Valley tract, however, exhibited a reverse relationship, probably due to selective logging of the ungrazed portion conducted several months before sampling. The wide variation observed in porosity and permeability of the individual samples from this area tends to substantiate this assumption.

With no exception, the grazed soils showed a higher resistance to the passage of forced air than did the ungrazed soils. In some instances, the air permeability of the ungrazed woodlot soils was as much as eight times higher than that of the grazed soils. A close correlation between water permeability and air permeability was observed.

The soil for the chemical analysis was sampled to a depth of 3 inches by means of a sampling tube. The shallow depth of sampling was used to amplify the effects of grazing. Six composite samples were obtained from each woodlot. The determination of the pH values of soil was made electrometrically by means of a potentiometer. The content of organic matter was found by the chromic acid titration method (*13*). Available phosphorous was analyzed colorimetrically by extraction with a dilute acid solution and subsequent treatment of the filtrate with ammonium molybdate and stannous chloride (*15*). The content of available potassium, after extraction with ammonium acetate, was found by means of the spectrophotometer (*2*). The replaceable calcium and magnesium were determined by a modified micro technique (*11*). The results of the chemical analysis of grazed and ungrazed farm woodland soils are given in Table 4.

The pH values of grazed and ungrazed soils show only slight and inconsistent differences. The content of available phosphorous and replaceable calcium and magnesium present a rather erratic picture which prohibits a general conclusion. It is possible that, in some cases, the state of these factors in the analyzed surface layer of soil was affected by manuring action of livestock. The greater organic matter content in the ungrazed soils was found to be statistically highly significant. The available potassium in the soils of the ungrazed woodlands is also significantly higher than that of the grazed woodlots.

Literature Cited

1. ALDERFER, R. B. 1946. Seasonal variations in the aggregation of Hagerstown silt loam. Soil Sci. 62: 151-168.
2. ATTOE, O. J. and E. TRUOG. 1947. Rapid photometric determination of exchangeable potassium and sodium. Soil Sci. Soc. Amer. Proc. 11:145-149.
3. BAVER, L. D. 1946. Soil physics. John Wiley and Sons.
4. BOUYOUCOS, G. J. and A. H. MICK. 1947. Improvements in the plaster of paris absorption block electrical resistance method for measuring soil moisture under field conditions. Soil Sci. 63:455-465.
5. CHANDLER, R. F. 1940. The influence of grazing upon certain soil and climatic conditions in farm woodlots. Jour. Amer. Soc. Agron. 32:216-230.
6. COTTAM, GRANT. 1947. A point method for making rapid surveys of woodlands. Bull. Ecol. Soc. of Amer. 28:60.
7. DENUYL, D. and R. K. DAY. 1939. Woodland livestock carrying capacities and grazing injury studies. Purdue Univ. Agric. Exp. Stat. Bull. 391.
8. GUISE, C. H. 1950. The management of farm woodlands. McGraw-Hill.
9. LEAMER, R. W. and B. SHAW. 1941. A simple apparatus for measuring noncapillary porosity on an extended scale. Jour. Amer. Soc. Agron. 33: 1003-1008.

10. LUTZ, H. J. 1945. Soil conditions of picnic grounds in public forest parks. Jour. Forestry 43:121-127.
11. PETERSON, A. E. 1950. Micro method of calcium and magnesium determination. (Unpublished report. Copy on file, Dept. of Soils, Univ. of Wis., Madison.)
12. RAUNKIAR, C. 1918. Recherches statistiques sur les formations vegetales. K. Danske Vid. Selsk. Biolog. Medd. 1 Kobenhavn.
13. SCHOLLENBERGER, C. J. 1939. Determination of soil organic matter. Soil Sci. 31:483-486.
14. STEINBRENNER, E. C. 1950. An improved method for determining the water permeability of forest soils. Soil Sci. Soc. of Amer. Proc. 15: (in print).
15. TRUOG, E. 1930. The determination of readily available phosphorous of soils. Jour. Amer. Soc. Agron. 22: 874-882.
16. U. S. DEPT. AGRIC. 1950. Agric. Handbook No. 13. Forestry handbook for the upper Mississippi region. (Fifth Ed.).
17. WILDE, S. A. and E. C. STEINBRENNER. 1950. Determination of air permeability of soil by means of a sphygmomanometer. Jour. Forestry 48:840-841.
18. WILDE, S. A., F. G. WILSON, and D. P. WHITE. 1949. Soils of Wisconsin in relation to silviculture. Wis. Cons. Dept. Bull. 525. 171 pp.
19. YODER, R. D. 1936. A direct method of aggregate analysis and a study of the physical nature of erosion losses. Jour. Amer. Soc. Agron. 28: 237-251.

Composting Coarse Hardwood Sawdust With A Bacterial Accelerator

C. S. Walters, H. W. Fox, and H. B. Wycoff

Associate professor of forest utilization research, Illinois Agricultural Experiment Station, Urbana; Forester-manager, Sinnissippi Forest, Oregon, Ill., and superintendent, State Tree Nursery, Topeka, Ill.; respectively.

SAWDUST is the principal waste product of most sawmills. Its coarseness, high moisture content, scattered supply points, and high handling costs are the principal characteristics which make its use difficult. If the coarse sawdust produced by the 1,200 small sawmills in Illinois could be composted for use by local farmers, the disposal problem would be solved and the principal by-product of the industry could be put to productive use.

When used as a soil conditioning agent, raw sawdust has a temporay detrimental effect on the growth of many crops, because the cellulose-destroying organisms are unable to obtain their nitrogen requirements from the sawdust and draw their supply from the soil. The depletion of the nitrogen content of the soil temporarily decreases crop growth and yield. However, when properly composted, sawdust improves the physical characteristics of the soil and crop growth.[1] The rotting of hardwood sawdust may require several years, and most sawmills do not have sufficient space to store the bulky material for the length of time required for it to rot.

There are no known published reports of controlled tests in which bacteria have been used to accelerate the composting of hardwood sawdust. The tests described in this report were initiated by the University of Illinois Agricultural Experiment Station in cooperation with the Illinois Department of Conservation, Division of Forestry, and Sinnissippi Forest, Oregon, Ill.

Materials

The sawdust used came from two small circular-saw sawmills. The compost heap built at Sinnissippi Forest, was composed of sawdust which accumulated from the sawing of a mixture of species, largely red, black, and white oak. The two heaps built at the Mason State Tree Nursery, Topeka, probably contained sawdust of bottomland hardwood species (soft maple, elm, etc.) as well as oak. The sawdust produced by these mills was coarse, often containing cube-like pieces of wood 3/16 inch on a side, although most of it would probably pass through an 8-mesh screen.

The soil used in all compost heaps was brown sandy loam.

The limestone was of a coarsely ground grade commonly referred to as "field limestone," since it was prepared for agricultural use.

The manufacturer of the compost accelerator[2] used in these tests indicated that it would convert "garden rubbish into manure in five or six weeks." In a letter to the senior author, dated April 13, 1949, an agent of the manufacturer stated "our Costa Rica agents inform me that both sawdust and coconut husks are successfully composted there. . ." A description of the accelerator in the literature providing instructions for its use states that it is "composed of bacteria bred on a special medium and arrested or rendered dormant. The bacteria are accompanied by a food supply which, when the bacteria are subsequently activated, carries them through the initial stages of growth and increases their voracity." The accelerator was prepared for use in an aqueous solution according to instructions of the manufacturer.

Methods

The first compost heap was built in June 1949 at Sinnissippi Forest, using sawdust which had been previously wet with water. Each layer of sawdust, about 3 inches deep, was placed over a ½-inch layer of limestone. The sawdust was then sprinkled with the composting solution and covered with a layer of soil about 1 inch deep. Additional layers of limestone, sawdust, and soil were added until the heap reached a height of 3 to 4 feet, and an average width and length at the base of about 5 and 7 feet, respectively.

[1] Wood Products for Fertilizer. Bulletin No. 7, Northeastern Wood Utilization Council, New Haven, Conn., 1945.

[2] The authors wish to thank Fertosan, Ltd., Wolverhampton, Staffs, England, for their cooperation in supplying the accelerator for these tests.

Two more compost heaps were built at the Mason State Tree Nursery in late July 1949. They were constructed in a manner similar to that used in building the first heap, with two exceptions: (1) one heap, the control, was not treated with compost accelerator, and (2) the heaps contained no limestone.

Each heap was completely covered with an outside layer of soil about 2 inches thick. It was estimated that 8 bushels, about 200 pounds, of sawdust was used in each layer and that each heap contained 1,000 pounds of sawdust. Approximately 3 man-hours of time were required to build a 1-ton compost pile.

All heaps remained continuously moist during the test.

Inspections.—All compost heaps were inspected 6 weeks after building. A second and final inspection was made in July 1950, approximately 1 year after the heaps were built. Particles of sawdust from a layer near the bottom of each heap were also examined with a microscope at 18x and 144x magnification.

Culturing.—Cultures of bacteria were grown on a potato dextrose agar medium[3] and were transferred to agar slants. Later, additional cultures were made, using a citrate medium in order to give an inorganic medium and an ordinary dextrose broth for a highly rich medium. No special tests were made, such as those for cellulose-digesting organisms or special nitrate-producing organisms, since we believed that they should follow field testing.

Results and Discussion

Inspections.—Six weeks after the compost heaps were built, an inspection was made of the sawdust in all three heaps. There were no noticeable changes, except a darkening in color, in the physical properties of the sawdust to indicate that composting (decay) was taking place in either the treated or untreated heaps. The discoloration was partially due to the soil used. Although the sawdust particles were not prepared for sectioning and detailed study, they were examined under a microscope. This examination showed no visible evidence of decay. No myceliae were observed in the heaps

A final inspection at the end of a year showed no noticeable changes in the physical properties of the sawdust. In fact, there was, with one exception—the formation of mycelial strands—little evidence to show that composting had progressed beyond the stage observed at the first inspection. Mycelial strands were found in the treated heap containing the field limestone, but not in either of the other two heaps. The strands penetrated all component layers and were observed in all areas of the heap except the drier, outermost covering of soil.

Laboratory tests of accelerator.—Dr. J. C. Carter, who prepared the first cultures, wrote the senior author in July 1949 that he had found "Five cultures of bacteria . . . (which) are single colony isolates. They produce different types of colonies which suggests that they may be different species. However, I cannot assure you that each isolate is a pure culture." Some of the bacteria showed evidence of being gas-forming types.

Dr. F. M. Clark indicated in correspondence dated January 1950 "the organisms I found were quite similar in both cases [referring to culture mediums]. To me, they are the types which one would ordinarily expect if he plated out soil or any other material of that type. They consist of a mixture of spore-forming and nonspore-forming rods, with quite a number of coccus forms of various types. The organisms growing in the citrate medium differed only slightly from those in the dextrose medium. There were a few more clostridial types growing anaerobically in the dextrose medium than in the citrate medium."

Summary and Conclusions

Three compost heaps were built of alternate layers of coarse, hardwood sawdust and soil. The sawdust in two heaps was treated with a liquid, proprietary, bacterial, compost accelerator. One of these heaps also contained a layer of coarsely ground field limestone beneath each layer of soil. The third heap (control) was not treated with the compost accelerator and contained no limestone.

The heaps were inspected after 6 weeks and again after 1 year to determine the extent of composting. Both inspections showed no visual differences between the sawdust in the three heaps, except darkening in color, and the development of mycelial strands after 1 year in the treated heap containing limestone.

The compost accelerator may be beneficial in composting "garden rubbish" which lacks the lignified structures of wood, but it was not effective in hastening the composting of hardwood sawdust of the species used in the tests. It is possible that the tannin and other water-soluble extractives in the sawdust were toxic to the organisms of the accelerator. The authors conclude that results similar to those obtained by treating sawdust with a commercial bacterial compost accelerator could have been obtained by using commonly recommended composting practices without the accelerator.

[3]The authors wish to acknowledge the help given them by Dr. J. C. Carter, plant pathologist, Illinois Natural History Survey, and Dr. F. M. Clark, associate professor of bacteriology, University of Illinois, and to thank them for preparing cultures of the accelerator and reporting their observations.

Notes

Water Resources and the National Park System

A statement by the National Park Service to the President's Water Resources Policy Commission.

The national parks and national monuments are a national possession; they are of concern to the whole nation. Every action which might affect them must, therefore, be determined by the national interest. They are set aside to provide for those kinds of enjoyment which people can obtain only through contact with superlative works of nature, protected to the utmost degree against modification or artificialization.

The inviolate protection of these unique museum pieces of "original America" is required under specific acts of Congress. These are the bases of land management policies which have been given constantly stronger support by the people of America ever since Yellowstone National Park was established in 1872. Manifestly these areas are not looked upon as reservoirs of resources to be drawn upon for commercial or economic ends; yet those resources are utilized, without being used up, to contribute to the physical, mental and spiritual well-being of millions of Americans each year. While the parks have an important part in the economy of the nation because of their relation to the travel industry, there are higher and more important values which are their reason for being. We cannot express the "profits" in dollars, but we know they are tremendous. Yet only by maintaining the integrity of the parks can these values be realized to the full.

Of major importance among the features of the parks and monuments are their natural waters—their streams and lakes and waterfalls. The grandeur of their scenery; the scientific interest of their forests, their wildlife and their geological formations; the natural interrelationships of plant and animal life—all these can be maintained only if the waters and the lands alike are kept unchanged.

From the standpoint of water utilization, nevertheless, the areas of the National Park System play an important role, for within their boundaries the highest order of natural watershed protection is practiced. Here are no hillsides and mountain slopes denuded and eroding because of lumbering or excessive grazing; no industrial wastes or mine "tailings" or sewage are permitted to pollute their streams.

The areas so managed retain their intrinsic values from which there are constant social dividends; indeed, these are certain to increase rather than diminish as the natural resources of the nation are exploited for commercial use, and unspoiled, unmodified areas become progressively scarcer.

Bases of the policy of complete protection.—It is important that there be full understanding of the basis, and the strength, of the primary land management policy applied to the System. The act which established Yellowstone National Park was approved by President U. S. Grant on March 1, 1872. Since then, the Congress has repeatedly made plain its intention that the national parks, national monuments and other areas constituting the National Park System are to be held free of any use which would modify or destroy the natural conditions, scenic beauty, historic or pre-historic objects, or wildlife, for the enjoyment of which these areas were given their special status. Differing in character, purpose and management from any other federal holdings, they cannot, in the usual sense of the term, be "integrated" into plans in which a basic purpose is the direct economic utilization of natural resources.

It is the considered and firm viewpoint of the National Park Service, therefore, not only that these areas are to be kept free of water control structures and of the modifying effects of such structures outside their boundaries, but also that the planning of water resources programs must halt at their boundaries. Only when the economic stability of the nation, or its safety, require it, should there be any exception to the well established principle of inviolability of the national parks.

The Yellowstone National Park Act required "the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders within said park and their retention in their natural condition." That act set a pattern which, with rare exceptions, was adhered to with respect to the national parks established thereafter.

Purpose of parks and monuments.—The act of August 25, 1916, which authorized the establishment of the National Park Service, embodied this basic management principle in its definition of the purposes of the national parks, monuments and reservations. The purpose, according to the act, was "to conserve the scenery, the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Congress has strengthened policy.—The Federal Water Power Act, passed in 1920, failed to provide protection to the national parks and monuments against use for power projects. President Wilson noted this omission and consented to sign the act only after being assured that the following session of Congress would remedy it. An amendment passed in 1921 exempted the then existing parks and monuments; in 1935, however, a further amendment extended the exemption to all which might thereafter be established.

The Congress has provided additional support to this principle of protection on numerous occasions. During the 1920's, for example, there were repeated attempts to gain approval of bills which would have permitted the damming of the outlet of Yellowstone Lake, in order to control the flow of the Yellowstone River for downstream irrigation. There were also efforts for a number of years to obtain legislation to permit the construction of a dam or dams in the Falls River Basin, in the southwestern part of the park. None of these was successful.

The major exception to this record was the authorization of the Hetch-Hetchy dam in Yosemite National Park in 1913, against opposition that would undoubtedly have been stronger had the parks been better known. Actually, San Francisco could have obtained its water more cheaply and more quickly elsewhere. In the flooding of this valley something great and fine was destroyed and something commonplace provided in its stead. It is not believed that public opinion would support such a step today.

That Congress is still convinced of the necessity of safeguarding the national parks against unjustified encroachments is confirmed by two recent decisions on legislation dealing with proposed impoundments. The first authorized the construction of the

Mining City Dam, in Kentucky, by the Corps of Engineers only if it would not damage Mammoth Cave National Park. In another case, Senate Bill 75, which would authorize the construction of the Bridge Canyon Dam on the Colorado River, and which in its original form would have made elevation 1877 the minimum height of the dam, was amended on the Senate floor to make that the maximum height, in order to limit the encroachment of the impounded waters into Grand Canyon National Park.

Interior Department supports policy.—The Department of the Interior has also consistently supported this long-established policy. Secretaries Lane, Payne, Work, Wilbur, and Ickes were consistent defenders of it. Former Secretary Krug announced himself as opposed to any exploitation of the parks or monuments "that cannot be justified on the basis of need so great that the economic stability of our country, or its existence, would be endangered unless such use were permitted;" and Secretary Chapman has insisted that only when required in the national interest may any one of these areas be subjected to any impairment or loss of natural character.

Three recent department actions indicated that this support is real. One was its steadfast opposition to the Glacier View Dam project, reflected in the joint decision of the Departments of the Army and Interior to drop it from the Columbia Basin development program. Another was the order issued by the Interior Department, prohibiting the Bureau of Reclamation from explorations looking to the construction of the Kanab Creek tunnel because, if constructed, it would virtually have stripped the Grand Canyon of the flow of the Colorado River, one of the essential elements in the story of the canyon's creation. The third was the department's request that Kings Canyon National Park be expressly excluded from the proposal, embraced in pending legislation, to authorize studies of the entire Kings River Basin for prospective dam sites.

Reservoirs and recreation.—The greatest threat to the integrity of the national parks and monuments today comes from water control proposals. One of the most persistent and fallacious arguments urged in behalf of these proposals is that a reservoir in a national park or monument will enhance its value for recreation. As a matter of fact, however, the mere provision of those types of recreation which may be obtained from a reservoir—even though more persons may avail themselves of it—does not compensate for the destruction of unique scenic or scientific or historic values. The opportunities to provide still-water recreation are almost limitless outside of the National Park System. There is no "just as good" substitute for Glacier or the Grand Canyon, any more than there is for da Vinci's Last Supper or the Gutenburg Bible.

Enhanced recreational opportunities are not a part of any reasonable justification for invading a national park or monument with water control construction.

The National Park Service fully recognizes the importance, in the provision of adequate recreation for all the people, of water recreation. On lands where their construction will not involve the destruction of superlative and unique features, reservoirs can, without question, provide the means of a great deal of beneficial enjoyment. The Service, cooperating with both the Bureau of Reclamation and the Corps of Engineers, as well as with other federal agencies and with the states and their political subdivisions, has, to the fullest extent possible with available funds, analyzed existing, proposed, and potential reservoirs, looking toward the full utilization of all water resources in the national plan of recreation. It must be pointed out, however, that not all reservoirs and streams have recreational value; also that in some cases where such value exists, there may be no present demand for it.

Essentially, the National Park Service makes a plea for proper balance between the economic (that on which we rely to make a living) and the cultural (that which enables us to live fully) in the utilization of our natural resources. It would be folly to set aside such large quantities of land and water for recreation that the ability of the people of the country to make a decent livelihood is curtailed; it would similarly be folly to develop our resources for economic use beyond genuine need and to the detriment of our opportunities to enjoy our fair share of mental and spiritual satisfactions—those experiences which lift us above the beasts of the field. All this the Congress and the people of the United States have had in mind in supporting the institution of the national parks.

Relationship of the National Park Service to the whole recreation field.—In 1936, the Congress, becoming conscious of the necessity of coordination in planning for the recreational requirements of the American people, present and future, laid upon the National Park Service the responsibility of formulating a "national program of recreation" in cooperation with other federal agencies and with the states and their political subdivisions. In the provision of recreation, several other federal agencies play an important part: state parks, widely distributed and within easy reach of tremendous populations, count their visitors in excess of 100,000,000 a year; while counties, metropolitan districts and cities meet the day-by-day recreational needs of their own populations with their own systems of parks and playgrounds. The National Park System, then, is simply a part of the over-all public provision for the use of leisure time in the out-of-doors; but that part is a very distinct one. It is to protect and preserve unimpaired for public enjoyment the "crown jewels" of the Nation's scenic, scientific and historic heritage.

Physical Properties of Brown Forest Soils After Felling[1]

This article reports the results of investigations on the effects of cutting upon soil-water relations in mountain areas of the Transcaucasus and eastern Georgia regions of the Soviet Union. The purpose was to develop standards of timber harvesting that would best assure maintenance of stream flow conditions favorable to the generation of hydroelectric power and water supplies for irrigation agriculture.

The areas investigated support mainly mixed spruce, fir, and beech stands on the upper slopes to timberline, and oak-hornbean with an admixture of pine on the middle slopes. Soils are classified in the brown forest soils group. They have a well developed humus layer, faintly developed "B" horizon, and a well defined nutty structure.

Sites subjected to clear cutting and to varying degrees of thinning and partial harvest cuts were sampled to determine the effects on porosity (total, capillary, and non-capillary) and permeability of the upper soil horizons.

Detailed statistical analysis of the measurements revealed that: (1) Degree of cutting definitely affects the physical properties of the soil. Clear-

[1]Abstract from translation of article, "Changes in the main physical properties of brown forest soils after felling," by V. Z. Hulisashvili. Pochvovedenie, Moskva. 9: 539-549. 1945.

cutting in most cases markedly reduces total porosity, non-capillary porosity, and percolation capacity. (2) Partial harvest cuts and thinnings have no appreciable effect until stand density (crown canopy) is reduced to 0.3 The effects at this density are substantial —nearly as great as for clear-cutting.

Selected results from the detailed tabulations are as follows:

EFFECTS ON POROSITY

Type and condition	Total porosity	Capillary porosity	Non-capillary porosity
	Percent		
Pine-spruce-oak			
Before felling	63.6	53.2	10.4
Clear-cut	57.9	52.8	5.1
Beech-oak			
Before felling	63.2	49.8	13.4
Clear-cut	57.9	52.8	5.1
Spruce			
Density 0.7	65.9	35.4	10.5
Thinned to 0.3	61.9	54.7	7.19
Beech			
Density 0.3	54.5	47.0	7.5
Clear-cut	50.8	47.6	3.2
Density 0.8	65.3	54.0	11.3
Density 0.5	62.9	51.5	11.4

EFFECTS ON PERMEABILITY

Forest type and condition	Initial test	After saturation
	Minutes for water to percolate into soil	
Pine-spruce-oak		
Before felling	25.6	48.8
Clear-cut	102.6	171.6
Spruce		
Before felling	0.91	—
Clear-cut	11.	—
Beech		
Density 0.3	3.8	—
Thinned to 0.5	2.4	—
Beech		
Density 0.3	20.3	—
Clear-cut	77.5	—

BERNARD FRANK,
U. S. Forest Service.

Observations on Litter Fall and Foliage Nutrient Content of Some Pacific Northwest Tree Species

Much research on the contribution of plant residues to soil fertility has been done in European countries and in the eastern United States. Little is known, however, about the quantity and quality of the litter fall of trees of the Pacific Northwest. Some preliminary observations are presented here concerning the annual litter fall of ten major tree species of the Pacific Northwest, both as to quantity of material returned to the soil and of the nutrient supply contained in that material.

In pure, well-stocked stands of each species, needle or leaf samples were taken together with samples of the soil humus layer and of mineral soil at 0 to 2 inches and 8 to 10 inches depth. The needle and leaf samples were analyzed for their content of nitrogen, phosphorus, potassium, calcium, and magnesium. Soil reaction or pH was determined for the humus layers and the soil samples.

Besides the analytical work, measurements of the annual fall of litter of each species were made by spacing 4-foot-square leaf traps beneath the stands. The total amount of litter collected over the course of one year was oven dried and weighed and the resulting figure was then converted to the oven dry weight of litter per acre that is deposited annually by such a stand.

Several factors must be taken into consideration in the interpretation of the annual litter fall and the nutrient contents (Table 1). It is known that the nutrient content of forest tree leaves varies during the growing season; that the leaf composition is influenced greatly by environment, especially the soil; and that the amount of litter fall varies markedly from year to year. In light of these variables, this evaluation of the seasonal contribution of plant nutrients through litter fall must be regarded only as a broad estimate. In the absence of periodic, long-time sampling, however, the data are still of interest as a general comparison between species, and they serve as a beginning toward determining the relative fertilizing effect of the litter of major Pacific Northwest tree species.

The extremely high nitrogen value found for red alder is of interest since the root nodules found on this species are reputed to fix nitrogen symbiotically, and the possible value of alder as a soil conditioner is suggested.

Phosphorus values were relatively low for all species, as has been found true in other foliage nutrient investigations. Low phosphorus values are characteristic of the highly acid Pacific Northwest soils, in which much of the natural phosphorus is tied up in relatively insoluble iron and aluminum compounds.

The only two broadleaved tree species included in this study, bigleaf maple and red alder, contained very high amounts of potassium as compared to the conifers. This difference has been found in other areas, although Lutz and Chandler[1] indicate that broadleaved species also contain higher amounts of magnesium and

[1]Lutz, Harold J. and Robert F. Chandler. Forest soils. 514 pp. N. Y. Wiley, 1946.

TABLE 1.—LITTER FALL AND FOLIAGE ANALYSIS FOR TEN PACIFIC NORTHWEST TREE SPECIES

Species	Annual litter fall, oven-dry weight	Foliage nutrient content					Total weight of nutrients	Soil pH		
		N	P	K	Ca	Mg		Ao Horizon	0-2 in. Depth	8-10 in. Depth
	Pounds per acre									
Western redcedar	1,914	11.9	1.7	6.9	42.8	0.8	64.1	4.20	4.51	5.26
Douglas-fir, 350-year-old	1,770	15.2	2.7	2.7	16.6	0.5	37.7	3.99	4.92	5.07
Pacific silver fir	1,582	19.8	1.9	3.8	14.5	0.9	40.9	3.77	4.35	5.02
Bigleaf maple	1,319	15.1	1.6	14.9	21.4	0.2	53.2	5.55	5.54	5.15
Western white pine	1,205	9.2	1.4	3.6	7.5	1.0	22.7	3.87	4.46	5.02
Red alder	1,172	27.6	1.5	11.6	9.6	0.1	50.4	4.22	4.10	4.20
Western hemlock	936	7.2	1.0	1.8	5.6	0.6	16.2	4.15	4.30	5.10
Douglas-fir, 100-year-old	822	7.0	0.7	1.7	8.0	0.2	17.6	4.85	5.05	5.50
Sitka spruce	804	9.3	0.8	1.9	3.9	0.7	16.6	4.14	4.20	4.47
Ponderosa pine, 100-year-old	718	5.6	0.7	3.2	2.7	0.6	12.8	4.20	5.95	5.50
Ponderosa pine, 350-year-old	548	2.8	0.4	1.9	2.3	0.4	7.8	4.06	6.13	6.15
Lodgepole pine	255	2.5	0.2	1.1	1.4	0.2	5.4	4.92	6.03	6.23

phosphorus, which is not indicated by these figures.

Western redcedar and bigleaf maple foliage were the only two samples which contained more than 1 percent calcium. Redcedar contained twice the amount of calcium as bigleaf maple and thirty times that of lodgepole pine, which had the lowest amount. In general, it might be said that western redcedar resembles eastern *Thuja* in calcium content, while bigleaf maple appears to be within the range of eastern sugar maple. Hemlock, white pine, and silver fir are not greatly different in calcium content from their eastern counterparts.

Ponderosa and lodgepole pine foliage both were well at the bottom of the list for nutrient content and for total annual fall of litter. Western white pine foliage had a generally higher nutrient content than did ponderosa and lodgepole, which is in keeping with its characteristic of growing on somewhat better sites than the other two pines.

Soil reaction did not follow closely the content of calcium in the foliage of the trees. Many other factors which combine to influence soil reaction mask the relationship between calcium and pH when only this limited number of samples is considered.

The findings emphasize the soil-building value of western redcedar and red alder in western forests and should be of use in the control of species composition in reforestation programs.

ROBERT F. TARRANT and LEO A. ISAAC, *Pacific Northwest Forest and Range Experiment Sta. Portland, Ore.*, and ROBERT F. CHANDLER, JR., *president University of New Hampshire, Durham.*

Southern Pines from Different Geographic Sources Show Different Responses to Low Temperatures

Uncommonly severe cold in the late fall and winter of 1950-51 in southern Illinois caused different amounts of damage to southern pines depending upon their geographic seed sources. Observations of shortleaf and loblolly pine 1-0 nursery stock at the Union State Tree Nursery near Jonesboro, Ill., and 3-year-old trees in field plantings are reported here.

The literature is replete with somewhat similar occurrences but these observations are reported to emphasize further the influence seed source may have upon the outcome of reforestation projects.

The unusually low temperatures experienced in southern Illinois last winter may be expected only once in every 10 to 20 years, but often enough to bring at least partial failure to a forest planting if the stock is not properly chosen with respect to source. Maximum Fahrenheit temperatures from October to November 3 at Carbondale, Ill., were in the high 70's and 80's nearly every day. There was a light frost on November 5 and from November 11 to 13, minimum temperatures ranged from 17 to 22 degrees. During the rest of the month days were mild but at night temperatures were slightly below freezing. On November 25 the minimum temperature ranged from zero at Carbondale to 8 below at the Union State Tree Nursery. There were five other periods of zero or near zero temperature in December and January. On February 2 the minimum temperature was 22 degrees below zero, the lowest in Carbondale since 1912.

Nursery beds with stock of different seed sources showed marked differences in damage. At the Union State Tree Nursery, most of the 1-0 loblolly pine from eastern South Carolina seed sources were killed. The 1-0 loblolly stock from Maryland and Arkansas sources, on the other hand, showed a slight browning of the top needles but negligible killing. It was striking to see the beds of seedlings from the different seed sources side by side in the nursery. They presented a strong argument for recognizing the importance of seed source in forestry practices.

According to L. H. Kahler, nurseryman at the Union State Tree Nursery, damage to the loblolly pine in the seed beds occurred during the late November sub-zero weather. The exceptionally cold weather early in February may also have contributed to the damage. In the nursery, loblolly pine was injured more by freezing than was the shortleaf pine, and the damage to both species varied by seed sources.

Nearby or adjacent beds of 1-0 stock of Scotch, Virginia, pitch, and jack pine, from a native source, were not damaged.

Replicated experimental field plantings of loblolly and shortleaf pines showed results similar to those in the nursery. Seedlings from all sources represented, grown at the Union State Tree Nursery, had been planted 2 years and ranged from 1 to 3 feet in height. Loblolly pine trees from the more southern and southeastern sources showed by far the greatest freeze damage (Table 1). Shortleaf pine trees from sources in northern Arkansas, Missouri, Kentucky, Ohio,

TABLE 1.—FREEZE DAMAGE[1] AS RELATED TO GEOGRAPHIC SEED SOURCES OF LOBLOLLY PINE PLANTED IN SOUTHERN ILLINOIS

Seed source	Replicated plots in uplands of southern Illinois				
	1	2	3	4	5
Mathews Co., Va.	None	Light	None	None	None
Worcester Co., Md.	None	Light	None	None	None
Southwestern Arkansas	None	Light	None	None	None
Throughout Mississippi	Light	Severe	Moderate	Moderate	Severe
Throughout South Carolina	Light	Severe	Light	Moderate	Severe
Pender Co., N. C.	Moderate	Severe	Moderate	Moderate	Moderate
Polk Co., Tenn.	———	None	None	None	———

[1]Freeze damage scale is as follows:

Light: Less than 20 percent of trees with needles browned. Few leaders killed and almost no trees dead.

Moderate: Twenty to 40 percent of trees with needles browned. A majority of affected trees had some leaders killed. Not over 5 percent of affected trees dead.

Severe: Over 60 percent of trees with needles browned. A majority of affected trees had terminal plus some side leaders killed. Over 10 percent of affected trees dead.

and Oklahoma showed no freeze damage; those from a Tishomingo County, Miss., source showed light to moderate injury.

Additional plots of two shortleaf-loblolly pine hybrids[1] with parental seed sources in Virginia and North Carolina showed no freeze damage.

Low temperature damage in which only the needles turn brown may be temporary. A new crop of needles will usually appear the next year. This sort of damage commonly retards growth for about a season. However, when leaders or whole trees are killed, the results are much more serious (Table 1).

These observations indicate the serious results that can occur if reforestation and nursery practices are carried out without regard for seed source. It also shows that the more southern and southeastern sources of southern pines should not be used for reforestation in southern Illinois and neighboring areas.

LEON S. MINCKLER,
Silviculturist, Central States Forest Experiment Station.

[1]The seed for all hybrids mentioned in this article was supplied by the California Forest and Range Experiment Station and planting stock was grown at the Union State Tree Nursery, Jonesboro, Ill.

Random Sampling within Circular Plots by Means of Polar Coordinants

The circular plot is frequently used as a sampling unit in forestry. Within the plot may be necessary to obtain samples of soil, to position rain gauges and other instruments, or to locate smaller trees from which ecological and other data are to be taken. Polar coordinates are the most convenient method for describing and locating the subsampling points because only a staff compass and a surveyor's chain are needed and this equipment need not be moved from the plot center.

Statistical methods usually require subsampling to be random with respect to the total area of the plot. However, because polar coordinates converge toward their origin, certain precautions must be taken so that the central part of the plot will not be over-sampled at the expense of the outer region. Here is one practical method of selecting subsampling points within circular plots:

The origin of the coordinates is the plot center. The angular coordinate is a bearing from magnetic north measured with a staff compass or an angle turned from true or arbitrary north with a transit. The distance coordinate is measured with a chain, usually in links.

A bearing is obtained by reading down a 3-digit column of random numbers to a number in the range 000 to 359. Suppose the random number is 293. An angle of 293 degrees is turned clockwise from true or arbitrary north if a transit is used. If a staff compass is used, the bearing is N 67 W. This is the bearing for a single subsampling point.

The distance along the bearing is obtained by drawing a 2-digit[1] random number. A decimal point is set to the left of the first digit. Next, the square root of the number is taken and this square root is multiplied by the plot radius. The product is the distance to proceed along the bearing to the subsampling point. Suppose the number drawn is 09. Set a decimal point to obtain .09; $(.09)^{\frac{1}{2}}$ equal .30. If the whole plot area is one-fifth acre, then the proper distance along the bearing N 67 W to the subsampling point is .30 (79.79) or 23.9 links. Had the plot area been one-fourth acre, the distance would be .30 (89.21) or 26.8 links.

[1]For very large plots a 3- or 4-digit random number may be used. The decimal point is always set to the left of the first digit. By increasing the number of digits, it is possible to approach the circumference of the plot more closely.

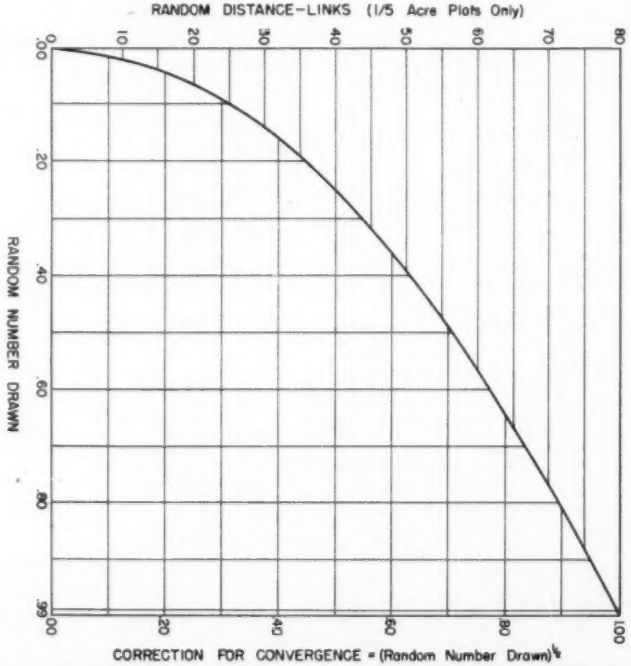


FIG. 1.—Graph for converting random numbers to random distances correcting for the convergence of polar coordinates.

Figure 1 converts random numbers to their square roots (ordinate, right scale) and to random distances for 1/5-acre plots (ordinate, left scale). For the example previously cited, read up from .09 on the abscissa to the curve and then left to the scale on the ordinate; the random distance for the random number drawn is 24 links on a circular 1/5-acre plot.

For a plot of some other area, read up from the abscissa and to the right to obtain .30; multiply this by the plot radius (in links, feet, or meters) to get the proper distance to the subsampling point.

Occasionally, a subsampling point will fall within the base of a tree. No set rule can be used when faced by this dilemma. If soil samples are to be obtained, it is best to draw alternate coordinates; when stocked quadrats are used one might correct for the area covered by tree bases or just take the quadrat as it falls within the base of the tree; when positioning instruments it may be best to place them as close as possible to the point originally drawn. These decisions are best made by the observer. Sometimes the area to be subsampled will extend beyond the circumference of the plot. Ordinarily this fault is not serious but it can be avoided by reducing the plot radius by the radius of the subsampling area.

R. N. GAISER,
Soil Scientist, Central States Forest Experiment Station, Athens, Ohio.

Figured Walnut Propagated by Grafting

The author recently was shown a small piece of figured walnut (Fig. 1) from a tree propagated by grafting. J. F. Wilkinson, Rockport, Ind. nurseryman, reported[1] receiving a number of scions from a wild tree located by George N. Lamb, a veneer manufacturer, and grafting them on native stocks in 1929. The grafted trees have since grown to pole size (probably 7 or 8 inches d.b.h.). One of them was cut recently, and

FIG. 1.—Walnut stem showing figure resulting from grafted wild scions.

the sample of figured wood was obtained from it.

Mr. Lamb purchased a number of logs from a buyer in Michigan and discovered that some of them were highly figured. He traced the logs' origin to a farm woods near Ada (Kent County), Michigan. The tree had been quite large (2,400 board feet merchantable volume) and forked near the ground. It grew on a river flat in a gravelly loam soil. According to Mr. Lamb, other figured trees were found in the same area.

The tree had been cut "for a number of weeks" before Mr. Lamb was able to locate the top and collect the scions. He indicated in a letter (November 27, 1929) to Mr. Wilkinson that "The figure in this tree was quite apparent, even in the small branches, while the Forest Products Laboratory found evidences of a developing figure in the twigs not over five years old." Mr. Wilkinson points out that the figure in the grafted tree is more pronounced "in the outer part than near the heart of the wood. . . ."

This is one of the very few reports on the propagation of figured wood by grafting. Whether this method of producing wood for industrial use has possibilities remains to be proved, since Mr. Wilkinson's trees are still less than 8 inches d.b.h.

C. S. WALTERS,
Illinois Agricultural Experiment Station.

[1] Wilkinson, J. F. The grafted curley walnut as a timber tree. Annual Report of the Northern Nut Growers Association, Inc. 39:139-142. 1948.

More on Bear Damage: Pack Rats

After my article "Bear and Squirrel Damage to Young Redwood" in the September 1951 JOURNAL, page 651, was submitted I had an opportunity to view damage to young redwoods wrought by pack rats. This was made possible by Gray G. Evans, logging superintendent, Hammond Lumber Co. Samoa, Calif. Mr. Evans was convinced that some of the damage attributed to bears was actually the work of pack rats.

Pack rats make large nests on the tops of large redwood stumps. Their droppings are collected by nurserymen or by woodsmen for sale to nurseries. The rats frequently nibble the bark of the surrounding redwood sprouts. That they do this to sapling sprouts has been observed many times in all the redwood counties, but that they completely girdle sprout trees having diameters of 6 to 12 inches and do so for 5 feet of the lower trunk, is something new. The strips of bark may be left dangling over the peeled portion. In contrast, when girdling is done by bears the bark is often stripped off completely from the ground line of 24-inch trees up to a point too small to support the animal's weight.

My earlier article must therefore be amended to acquit bears of doing *all* the damage. Pack rats must be charged for some of the lethal girdling. Nevertheless, bears are the more important of the two girdling agencies.

The area in which Mr. Evans and I observed lethal pack rat damage was used as a cattle range after it was logged and until the brush and redwood sprout clumps became too dense. Bobcats and coyotes were hunted out and probably nearly exterminated. Not unlikely the removal of the pack rat's enemies gave it a chance to multiply. By permitting the bobcats and coyotes to return and multiply, it is likely that the rats can be kept under control.

EMANUEL FRITZ,
University of California.

We Present

Dr. C. Audrey Richards

"During my association with her I've become a firm believer in woman's intuition. I've bucked her on many occasions when I thought she was on the wrong track, but she seems to have a seventh sense because nine out of ten times she's right."

That's how C. S. Moses, pathologist in the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, sums up his chief, Dr. C. Audrey Richards. One of our foremost wood products pathologists, Dr. Richards, for more than thirty years, has been prescribing cures or controls for our most versatile raw material. For much of that time she has been chief of the Madison branch of her division, which functions in cooperation with the U. S. Forest Products Laboratory at Madison, Wis.

It's all in the day's work for Dr. Richards to determine the effect of certain fungi on the wood decking of an aircraft carrier; how to protect military supplies from decay in the tropics; how to prevent stains; how to differentiate discolorations that may or may not lower the quality of lumber or affect its strength; why the floor of the library rotted away two years after it was built; why fence posts decay, or why wood pulp, veneer, or magazines get moldy.

Across her desk flows a stream of requests from governmental agencies, industrial concerns, and private citizens. Her aid has been enlisted in work with wood products of every description, from propellers to pulpwood, boats to boxes, fence posts to fine furniture.

She began this career in 1917, when she was appointed an assistant in forest pathology. For seven years she was the only woman in the Madison branch; today, as branch chief, she holds the highest position of authority ever achieved by a woman in the bureau.

In World War I, a period of marked expansion in products pathology, she was primarily concerned with the pulp and pulpwood industry and did research in Canadian, New York, and Wisconsin mills. She was associated with, among others, Otto Kress and C. J. Humphrey on work that culminated in valuable information on the control of decay and mold on wood pulp.

One of those trips to Canada Dr. Richards still refers to dryly as the "Canadian honker." She had been called to a Canadian paper mill to investigate a mysterious brown spot which kept recurring on the company's product. On superficial examination she believed that the stain was

C. Audrey Richards

oil, but was advised that such was impossible. After she had made an intensive investigation, the company found an oil leak in the machinery. "That was it," she says, "the Canadian honker—a wild goose chase—but fun."

Late in the 1920's, Dr. Richards was named acting director of the Madison branch. Her reign was short but so successful that she was placed in full charge in 1928. This was a year marked by Congress' passage of the McSweeney-McNary Forest Research Act, which paved the way for the pathological studies so sorely needed.

It was also an era of concentrated effort to find preventive controls for blue stain in lumber. Dr. Richards was in charge of evaluating the various chemicals considered for treatment. The stain-preventive qualities of more than 200 chemicals were explored in a cooperative program which led to the adoption by industry of the mercurial dip treatment. In less than ten years about one-sixth of the country's lumber was being treated.

Much of the work begun in early cooperative studies with the Forest Products Laboratory was basic and resulted in fundamental knowledge which served and will serve as a background for future research. Miss Richards is author or co-author of publications covering such pioneer subjects as the relation between durability and chemical composition of wood, the effect of decay on the chemical composition of wood, and the comparative resistance of wood-destroying fungi to various preservatives.

As administrative duties demanded more and more of her time, Dr. Richards was forced to forego direct participation in research for the vicarious thrill of directing and guiding her associates. Here, in her pride in her associates, her willingness to tell of their accomplishments — often soft-pedaling her own—one is able to discern the qualities that have made Dr. Richards an able leader.

With an infectious, youthful laugh she says, "I'm afraid I'm not very good copy! But Dr. (T. C.) Scheffer's work on blue stain is excellent, and I'm sure his work on decay resistance of oak and black locust will go down in the history of pathology."

Miss Richards' ability to appreciate —and to laud—the efforts of others has been reciprocated with fervent loyalty on the part of her associates. It is also an invaluable asset in maintaining the friendly spirit of cooperation that exists between her branch of the Division of Pathology and the Forest Products Laboratory. This spirit has been maintained so successfully that a committee set up in the early days to "iron out difficulties" found so little need for its services that it no longer exists.

Dr. Richards' work at present is almost completely administrative. She is, however, working with Dr. Catherine G. Duncan of her staff to establish a standardized method of evaluating wood preservatives by soil-block tests. Users and producers of treated wood are eager for some means—other than actual use tests, which may take years —of determining the relative effectiveness of preservatives. More than 30,000 test specimens have been examined in the course of this work.

Miss Richards began her career as a school teacher in her home town of St. Marys, Ohio, but left after three years to study botany at Miami University, Oxford, Ohio. She received her bachelor's degree in 1912, and her master's in 1914 from that institution.

and her doctorate from the University of Wisconsin in 1922.

She takes pride in the fact that she worked her way through school. "I was entirely on my own, and worked as sort of a maid-of-all-trades." (She usually neglects to mention that she did her undergraduate work in three years and was elected to membership in Phi Beta Kappa.) Her undergraduate studies were financed with a loan of $600—a sum now likely to be required for a semester—which was repaid in full in her first year of work after graduation. She was then earning $100 per month!

Miss Richards attributes her love of botany, forests, and forest products to her father. "Dad was a carpenter, not only familiar with wood as a useful material, but well versed on plant lore and wildlife. He used to take us on long walks through the woods and describe the various trees and plants with a little story. Dad taught us youngsters a lot."

Miss Richards, in her turn, has taught others a lot. She has frequently helped youngsters aspiring to service careers and has assisted, through courses in pathology at the University of Wisconsin and through supervision in the pathology laboratory, in the instruction of such outstanding students as Dr. Scheffer, now her associate; Dr. Robert Krause, wood preservation consultant of E. I. Dupont de Nemours and Company; Ira Hatfield, wood preservation consultant for Monsanto Chemical Company; A. Dale Chapman, owner of a chemical company dealing with wood fungicides; and Dr. Charles E. Owens, professor emeritus of botany and pathology at Oregon State College. It is largely through her efforts that students of Antioch College are doing practical research in her laboratory as part of their college studies.

She is active in the Botanical Society of America, the American Forestry Association, the Phytopathological Society, the Forest Products Research Society, and the American Association for the Advancement of Science. She is a frequent contributor to meetings of the American Wood-Preservers' Association, and incidentally is the only woman member. She also has the honor of being the first woman secretary of the Wisconsin chapter of Sigma Xi (honorary scientific fraternity), a past national president of Sigma Delta Epsilon (graduate women's scientific society) and is a past president of the International Altrusa Service Club of Madison.

Dr. Richards is known as an interesting conversationalist and an efficient organizer. This and her cheerful, relaxed manner keep her in constant demand as a committee-woman, an equally good hand on a picnic, or arranging for a scientific forum.

Although these myriad activities belie the age-old cliche about the weaker sex, Dr. Richards is not content to be an "8 to 5" worker. The Forest Products Laboratory is indebted to her for a unique splash of flowering color along its driveway, where she has constructed a magnificent rock garden on the face of a steep embankment. Spring and summer find her perched on a high ladder, planting, cultivating, or weeding. She seldom entrusts this chore to anyone else because there are so many varieties of flowers, ferns, and mosses that one must be an expert to care for them.

The grounds of her home at 1815 Regent Street are known as a show place among Madison's gardeners, and as a center of hospitality to her many friends and associates. Friends drop in from all over the country and are welcomed for a stay of two hours, two days, or two weeks. Their visit is often pictorially recorded by Dr. Richards, an accomplished photographer, in color, black and white, movies, or still pictures.

She may round out the day by relaxing with an intricate piece of needle work — lovely shawls, table cloths, or bedspreads that usually end up as gifts to friends. This most feminine of pastimes has been known to invade the hazy atmosphere of conference rooms more used to cigar smoke and deep bass voices. The staccato click of needles adds an anachronistic touch as Dr. Richards, fingers flying automatically, trades questions and answers with her masculine coworkers.

Dr. Richards is now completing her 34th year dedicated to the public interest. Her record fully epitomizes the motto of Altrusa, the woman's organization of which she is such an active member: patriotism—efficiency—and service.

JOHN K. MCDONALD,
Forest Products Laboratory.

❦❦❦

The greatest contribution of Forest Research is the spirit it has brought into the handling of national resources. Under the pressure of executive work, the technical ideas of the forester at times grow dim. It is Forest Research which has kept the sacred flame burning and has helped raise Forestry to the level of the leading scientific professions.

The research man must anticipate coming needs. He must of necessity be ahead of his time. That means standing alone, exposed to the skepticism and ridicule of those who live only from day to day.

From *Breaking New Ground* by
Gifford Pinchot, 1947.

Reviews

Forest Fires in the Northern Rocky Mountains.

By J. S. Barrows. 252 pp. Illus. Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mont. 1951.

Here is a publication of high significance to fire control personnel, legislators, and wild land managers. It presents a concise record of fire research conducted over the many years by the late Harry T. Gisborne and his associates of the Northern Rocky Mountain Forest and Range Experiment Station. Specifically the report is based upon an analysis of 36,000 individual forest fire records dating back to as early as 1908. The purpose of the analysis was to gain a better understanding of the occurrence, behavior, control, and effects of fires in order to provide essential information for improved planning and management of fire protection systems.

Most of the data are new and presented for the first time although they supplement in many cases earlier established principles and conclusions. This is due in large measure to the incorporation of statistics from recent years which have added materially to the mass of older data and strengthened the results obtained. The comprehensive analysis of data is presented in 122 figures and 64 tables with very concise presentation of results and conclusions. It is amazing that such a vast compilation of data can be given and discussed so succinctly.

By reading only the written portion of this paper one can obtain quickly, a summary of the three parts: The Regional Fire Problem; Fire Behavior; and Fire Control. To appreciate the fuller significance of the work it will be necessary to study carefully the figures and tables.

There is enough information here to make one well informed on the forest fire problem in the Northern Rocky Mountain region specifically and of the forest fire problem generally. Certainly, it is fire research in the critical Northern Rocky Mountain region that has done so much to provide the answers needed to meet the fire problems here and elsewhere.

This work is not only a tribute to the researchers who have labored to gather and anaylze the vast amounts of scientific data but to the system of federal forest and range experiment stations that makes possible a coordinated, long range attack on the fundamental problems facing American forestry. Research such as reported here could never have been accomplished without the resources of the federal forest and range experiment stations organized on a regional basis. It is a fine, fat dividend from investments in research made over a long period of years

MERRILL E. DETERS,
University of Idaho.

The Closing of the Public Domain: Disposal and Reservation Policies, 1900-1950.

By E. Louise Peffer, 372 pp. + xi. Stanford University Press, Stanford, Calif. 1951. $4.50.

For twenty years students of public land policy have been looking for a book which would bring the history of the public domain up to date—for a sequel to the classic treatment accorded to the public domain by Hibbard and Ise.[1] Here is the book. According to the author, the intended reference of the term "public domain" as used in the title is to the "vacant, unappropriated, and unreserved public land"—public domain in the narrowest sense. But she admits to having failed in her attempt to hold to this meaning. Most readers will feel that this "failure" has proved eminently successful. It has resulted in a book which relates "the steps by which the concept of the public domain has veered from one of land held in escrow pending transfer of title, toward one of reservations held in perpetuity in the interest of the collective owners." Thus we are given an integrated and authoritative account, not only of a major shift in the direction of public land policy, but also of some important steps in the expansion of the concept of the functions of American government.

Miss Peffer has much to say that will interest foresters. The very nature of her subject means that range lands receive particularly close attention. There are definitive chapters on such subjects as "The Dilemma of the Cattlemen," "Forest Grazing and the Public Domain," "The Taylor Grazing Act," and "Establishing Grazing Control." Through much of the book stalks the figure of Gifford Pinchot. Index references to the Forest Service involve more than sixty pages of text. The Forestry Fund fight of 1907, the Ballinger-Pinchot controversy, the jurisdictional dispute between Interior and Agriculture, the Stanfield McCarran, and Barrett Committee investigations, efforts to reorganize federal land administration, and other events of specific concern to foresters are described and interpreted in detail. A wealth of references to official correspondence and other original sources attest the diligence of the author's search for the basic facts of these and other incidents. But the book is not merely a chronicle. Relationships between events are clearly depicted so that we get an impression of the pattern of history, not just a picture of the pieces which compose the mosaic.

From the mass of evidence and detail Miss Peffer constructs a clear picture of the trend of public policy and of the aspirations and motivations of the numerous and varied groups whose activities were significant in determining the course which policy would take. Her critical pen launches barbs and bouquets with about equal facility. As a result, the individuals and

[1] Hibbard, B. H. A history of the public land policies. New York. 1939; and Ise, John. United States forest policy. New Haven, 1920.

groups who were concerned with the public domain emerge in significant detail, rather than as the black or white stereotypes to whom we have become accustomed. Many will disagree with some of Miss Peffer's critical evaluations. For example, she appears to the reviewer to exaggerate the influence of personal animosities as an explanation of jurisdictional strife. Perhaps others of her judgments give too little weight to experience in the field of operations, as distinct from that of policy. But this is beside the point. The main contribution of this book has been to bring together and analyze a major segment of the information needed before valid criticism can begin.

To the student of forestry or of policy, the book is "must" reading. To the professional forester, whatever his line of practice, it is highly recommended. It contains information both useful and illuminating. It depicts sharply some parts of the background of major current forestry problems which have previously been shadowy and obscure in the minds of most of us. It shows clearly the interrelationship at the policy level between forest conservation and the conservation of minerals, water, and other natural resources. It highlights the political hazards inherent in too narrow preoccupation with a single form of resource use.

The book is an outgrowth of a doctoral dissertation. In the later chapters, dealing with the period since 1936, one can sense that the author is no longer under the constraints imposed by a thesis committee, and her style takes on an added degree of liveliness. But from the beginning, Miss Peffer's writing is as good as her research, and her book is as interesting as it is informative.

HENRY J. VAUX,
University of California.

Ohio Maple Syrup—Some Factors Influencing Production.

By H. R. Moore, W. R. Anderson, and R. H. Baker. 53 pp. Illus. Research Bull. 718, Ohio Agricultural Experiment Station, Wooster. 1951.

This is a report of a four-year study carried out in cooperation with sixty maple syrup producers in Northeast Ohio. Nothing new was found in the study. Data obtained add support to conclusions reached by others.

There are so many variables having a direct influence on tree vigor —yearly weather fluctuations being of primary importance—that a study of this kind should encompass more than four [illegible]s. Conclusions drawn from data obtained reflect this fact. It was found that the average annual yields, 1946-1949, ranged from one pint to more than one quart per bucket hung. Sap yield from trees in five crown classes varied 600 percent; open grown trees yielded twice as much (33.7 to 14.77 gal.) as did forest grown trees. There were yearly variations in sugar content. Sap weather alone cannot be held wholly responsible. Annual rainfall and its distribution have a marked effect on the yearly growth and vigor of trees. This is particularly true when comparing open grown trees with those developing in a closed stand.

The authors observed that some sugar maples yielded very sweet sap. For trees studied, sap sugar content ranged from 0.3 percent to a high of 5.6 percent.

There are strains of sugar maple capable of yielding a high sugar content sap. Workers in Vermont and New Hampshire are studying this subject and trees yielding 7 percent plus sugar are being examined. It is practical to provide rooted cuttings as planting stock for developing a sugar orchard. Farm foresters should keep this in mind.

Of particular interest to foresters is the authors' conclusion that "at prevailing prices maple syrup production can be and usually is a more profitable use of land than timber production."

There are some foresters who have rationalized that heavy grazing of sugar bushes is desirable because it tends to eliminate vegetation that would interfere with walking from tree to tree when gathering sap.

Assumptions that openness of bush made sap gathering easier are not supported by this study. In ungrazed bushes there were an average of 41 buckets hung, 26 in grazed, with a time expenditure, per 100 buckets, of 10 man hours in ungrazed and 11 man hours when bush was grazed.

A. C. MCINTYRE,
Soil Conservation Service.

Some Fundamental Plant - Soil - Water Relations in Watershed Management.

By Leon Lassen, Howard W. Lull, and Bernard Frank. 75 pp. Illus. Mimeo. Forest Service, U. S. Dept. of Agric., Washington, D. C. 1951.

The purpose of this publication is to describe some of the fundamental plant-soil-water relationships that are basic to an understanding of watershed management. Knowledge of these fundamental relationships is also necessary in order to project research results to new areas in application.

The following subject matter sections were developed: I. The meaning of watershed management; II. The soil as a storage reservoir; III. Influence of vegetation on retention storage opportunity; IV. Soil water movement and temporary storage; V. Application to watershed management.

The authors explain and illustrate terms and concepts peculiar to the subject of watershed management. The contributions of surface, subsurface, and base flow to streamflow are shown diagrammatically and by the use of a hydrograph. The effect of land treatment on stream flow is discussed in terms of the fundamental properties and interactions of plants, soil, and water.

Two noteworthy illustrations show mechanistic examples of the relation between moisture tension and moisture content, and infiltration and allied processes.

In discussing the horizons of a soil profile the authors write,

"These layers are formed by differential weathering, by deposition of soils from different parent materials, one above the other, or by both processes." This is a unique if somewhat confusing explanation of how a differential soil profile is formed from soil material.

In the reviewer's opinion the authors selected many extreme, if not improbable, examples to show how forests may improve soil conditions for water retention, detention, and storage opportunity. These points are centered around two ideas: (1) the general favorableness of incorporated organic matter; and, (2) the effectiveness of plant roots in removing retention water from the soil and soil material (substream) thus increasing storage opportunity.

In comparing the soil conditions under undisturbed hardwood forest with those of cultivated fields, the writers point out that under the undisturbed hardwood forest the upper mineral soil (A_1 horizon) may have an organic matter content of as much as 20 percent by weight and very nearly 100 percent by volume. These two percentage values do not seem compatible.

On the basis of soil moisture data reported for an irrigated peach orchard growing in what was presumably an undifferentiated clay loam soil in California, the authors point out (as the data showed) that the trend of decreasing soil moisture measured at five-day intervals was the same at depths of one, two, three, and four feet. Also, the wilting percentage was reached at all depths at approximately the same time or date. However, this presumes that the area of absorbing surface (root surface capable of absorbing water) was the same at all four depths. In fact, in this special case, the area of root absorbing surface was probably uniformly distributed. The authors proceed from this specific example to the following generalization: "The above relations make it evident that a soil wet to field capacity throughout the depth of root penetration will dry at a rate such that the wilting point or any other point of equal force is reached at about the same time at all depths." The authors fail to point out, however, that in humid forest regions of the United States the distribution of water-absorbing surface in the form of small roots is not uniform from the surface downward in the soil. By far the greatest area of absorbing surface is very close to the surface of the mineral soil proper, within the upper 6 inches, and a large amount of small roots are in F- and H-layers of the unincorporated organic matter, if these layers are present. Hence, in such climatic regions, the upper part of the soil mass is periodically moistened to the field capacity by rain and reduced towards or to the wilting percentage by root absorption, the cycle being repeated many times during the growing season. In contrast, at lower depths of 3 to 4 feet, the soil may be at the field capacity at the beginning of the growing season and steadily decrease in moisture content during the season but never reach the wilting point.

Data are given on root depth for trees in the shelterbelt zone of the Great Plains. Tree species are listed in three classes of root depths, i.e. shallow (1 to 5 feet), intermediate (5 to 10 feet), and deep (10 to 20 feet). The authors point out that if storage (water) varied directly with root depth, and the average depth for each group was 2, 8, and 16 feet respectively, the areas with the deepest roots would have 8 times more potential storage capacity than the shallow rooted areas. If the average root depth for the deep rooted class is 16 feet, and if the authors believe that roots are uniformly distributed so that moisture could be removed down to the wilting point (as in the irrigated California peach orchard), it appears that the species listed as deep rooted would not be able to persist in the Great Plains because the annual rainfall is too low. Given a water holding capacity of only 20 percent by volume for the entire 16 feet (192 inches), it would require approximately 38 inches of rainfall to restore the moisture content to the field capacity. This is almost twice as much as does occur in the midshelter belt region.

Another example which affords interesting speculation, concerns soil moisture used by bunchgrass, alfalfa, and a plantation of mixed conifer and hardwood species in the Palouse region of southeastern Washington and the implications with respect to subsequent water storage potential at the end of the growing season. Alfalfa roots extended to at least 14 feet and reduced soil moisture to the extent that 48 inches of water could be stored. Comparable figures for the tree cover were 12 feet of root depth and 41 inches of rainfall. The bunch grass, whose roots went to only 6 feet, was able to effect storage space for only 20 inches of water. Perhaps this is good evidence of why the natural vegetation of this region of loessial soils is grass and not trees, and also why one would not expect to grow successive crops of alfalfa or plantations of trees indefinitely without irrigation. (The approximate average annual rainfall at Pullman, Washington is 21 inches.)

The reviewer believes that the authors have placed unwarranted emphasis on the effects of forests on increasing soil depth through the addition of organic matter at the surface. The principal role would appear to be the maintenance of a maximum water infiltration rate at the surface. Marked emphasis was also placed on the possibilities of controlling water storage opportunity through selection of shallow-, intermediate-, or deep-rooted species for watersheds. The reviewer believes that the depth to which tree roots can effectively remove soil moisture is so greatly influenced by the interactions of physical properties of the soil, distribution of effective rainfall, topography, aspect, and the nature of the surface geology, that inherent rooting habit of trees becomes relatively insignificant. Roots will grow and thus increase water-absorbing surface in that part of the soil where moisture, aeration, and mechanical properties are favorable. These conditions are fixed by the interaction of factors listed above.

A good account is given of factors affecting water infiltration and

percolation, and in distinguishing between infiltration capacity and infiltration rate. The authors point out the well known fact that percolation capacity of a soil is set by the least permeable layer. In line with this it appears to the reviewer that agencies concerned with watershed management could well afford to use the large amount of data on percolation rates and permeability that are being obtained on soils in various parts of the United States under different kinds of plant cover and use.

T. S. COILE,
Duke University.

Cooperative Forest Fire Control. By John B. Kling. 106 pp. State University of New York, College of Forestry, Syracuse 10, N. Y. 1951. 75 cents.

It was the author's belief that all grant-in-aid programs increase the trend toward centralized government, and that the Clarke-McNary forest fire control program is no exception.

But the Weeks and Clarke-McNary laws have been unique in an important respect, he pointed out in his analysis of the program, because the views of local, state, sectional, and federal people were obtained before the legislation was written. Furthermore, their interests have been continually considered during the program's forty years. This cooperative approach, Dr. Kling stated, set a pattern for setting up and administering all grant-in-aid programs.

According to the author, Clarke-McNary administrators have emphasized two objectives — obtaining a fair degree of forest protection on a wide area and maintaining healthy federal-state relationships. Throughout the book, he stressed "on-the-ground" practices which give a picture of day-to-day administration.

Dr. Kling made an intensive study of forest fire control programs in states along the Atlantic seaboard. *Cooperative Forest Fire Control* is based on his dissertation for the Ph.D. degree awarded him by the College of Forestry in 1949.

A native of Snoqualmie Falls, Wash., Dr. Kling was aged 29 when he died of polio. In the book's foreword, Dr. Hardy L. Shirley, assistant dean of the college, pays tribute to Kling as "a young man of unusual promise, distinguished as a military officer and rapidly developing a career in university administration."

Forestry in Farm Management. By R. H. Westveld and the late Ralph H. Peck. Second edition, revised. 340 pp. Illus. John Wiley and Sons, Inc., New York. 1951. $5.

Ten years ago when Westveld and Peck published the first edition of *Forestry in Farm Management* they achieved something which most foresters writing on farm forestry had failed to accomplish. They succeeded in presenting forestry to agriculturists *as a part of farming* rather than as a branch of forestry.

Their book was written in simple, nontechnical language, and although the subject matter was forestry throughout, the farm background was always there. The authors must have had a keen appreciation of the difficulty of holding the attention of a farm-minded audience in a subject which has traditionally been of little interest to them, and must consciously have striven to overcome this handicap. The book was not written for foresters, but for agriculturists.

The second edition differs from the first but little in general content and arrangement, and it retains the same point of view. Foresters who have not had much experience with farm forestry may feel that some of the technical matter is presented rather superficially, but experienced teachers of farm forestry in the classroom or in the field will recognize the futility of attempting to explain a mass of technical detail. They will be grateful for the simple clarity with which this book develops important principles, for the excellence of the examples used, and for the omission of highly technical matter in such difficult subjects as forest mensuration.

Although basically the same book, the second edition has been painstakingly revised. Probably the most significant changes are those which bring the factual information up to date. New monetary values are used throughout. All important new developments are described, including land-use capability classes, little-leaf disease and oak wilt, form-class volume tables, tree planting machines, improved logging devices, new techniques of naval-stores and Christmas-tree farming, modern methods of treating fence posts. A whole new chapter has been added dealing with the aids which are available to owners of farm forests and covering such features as government fire protection, seedling distribution, payments for approved forest conservation practices, on-the-ground assistance, sources of information, the provisions of the Clarke-McNary Law and of the new Cooperative Forest Management Act.

Most of the chapters cover substantially the same ground as before, although many sections have been completely rewritten to bring them up to date or make a more effective presentation. These chapters deal with the economic basis for growing tree crops, establishment of new woodlands, measuring forest products, measuring volumes and growth of forests, converting trees into wood products, use of wood on farms, management for special products, farm forests and wildlife, and farm-forest plans and records.

The introductory first two chapters have been rewritten as one with great improvement in readability and a more convincing exposition of the nature of forest tree crops and the importance of farm forests to agriculture. The subject of protection has been divided and incorporated in sections of two other chapters. Forces which tend to destroy the forest are described as part of the biological basis of growing tree crops, while protection measures are introduced

in several places in the chapter on improving and perpetuating existing farm forests. This may seem illogical to a forestry school graduate accustomed to filing "ecology," "silviculture," and "protection" in separate mental pigeonholes, but it is a much more logical presentation for the uninitiated agriculturist who has or will have a farm forest on his hands.

Throughout the book a fine balance is maintained between the theory and the practice of farm forestry, making it as well adapted as any one book could be to the varying needs of different classes of readers.

ROBERT T. CLAPP,
Mississippi State College.

An Annotated Bibliography of Aerial Photographic Applications to Forestry.
By C. William Garrard. 81 pp. State University of New York, College of Forestry, Syracuse 10, N. Y. 1951. 60 cents

Since World War I, aerial photographs have become a valuable forester's tool in mapping, cruising, fire and flood control, and in forest, range, and wildlife management.

A list, with notes, of all literature on forestry use of aerial photographs is now available. More than 300 articles, theses and publications are annotated, classified, and cross-indexed in the book. Literature is listed in 11 chapters under aerial photography, mensuration, survey, interpretation, equipment and techniques, films and filters, fire protection, recreation, wildlife management, range survey, and flood control.

In compiling the bibliography, Garrard consulted two main sources: library collections and published bibliographies. Listings, restricted to aerial photography in the forestry field, consist of all material published from 1916 to 1950, and many unpublished manuscripts. Examined intensively for articles were *Forestry Abstracts*, *Forestry Chronicle*, Journal of Forestry, *Photogrammetric Engineering*, *Timberman*, and *West Coast Lumberman*.

Garrard submitted the bibliography in partial fulfillment of the requirments for the M.F. degree awarded him by the New York State College of Forestry in 1950. A native of Port Alberni, B.C. he served as a flying officer in the R.C.A.F. in World War II. He received his B.S.F. from the University of British Columbia.

Conservation of Forest Resources.
By Kenneth Decker. 30 pp. Bull. 9. Mimeo. Bureau of Public Administration, University of California, Berkeley. 1951. $1.

One of a series of reviews prepared for and at the request of the California State Legislature, this is a careful and impartial job of reviewing the literature on the subject by a trained worker.

The importance of California's forests is set forth as is also the state's leading position as a lumber consumer. The report "concerns the use of the forests as a source of lumber and the efforts to increase this use and yet to make the source more rather than less productive." The drain on the state's forests has more than doubled in ten years and may be expected to increase while estimated replacement lags far behind. The drain in the West can be increased to relieve the pressure on eastern forests. California can survive the drain only by adequate planning and the more extensive application of selective cutting. "Reduced production in the face of rising civilian and military demand would increase the pressure on lumber prices. . . . If the problem is to increase production, it is also to increase the rate of renewal by growth. In addition to converting her large stand of static old-growth to a growing stand, California needs reforestation of idle forest lands, new plantings to develop full potential growth on present timber lands, and the reduction of hazards to such growth."

California has 17 percent of the nation's timber supply. Withdrawal is estimated at 4.5 billion board feet annually. "Of this, 3.8 represents the harvested crop and the remainder is lost to fire, insects and diseases. Net annual growth is estimated at 1.2 billion board feet. . . . The trend of withdrawal is upward. . . . Foresters believe the growth can be doubled in 50 years."

Withdrawal has concentrated on redwood, sugar pine, and ponderosa pine, which have made up 70 percent of the cut, but comprise less than half the timber stand.

The various losses and means for their reduction are analyzed at length, as are various means of improving and stabilizing forest management.

This report is valuable as a source book and guide for understanding the state's forest situation. Since many of the cited publications were published, much progress has been made to correct an unhealthy situation between drain and growth. Data on this progress, not being reported in print were not available to the author. The reviewer adds that helpful laws have been passed and repeatedly amended; private owners have shifted from a desire to dispose of or neglect their cutovers to retaining and rehabilitating them; the minimum requirements in state forestry laws are being exceeded on an increasing scale; more development on the national forests is relieving the strain on private lands; and there is a rapidly developing complete awareness on the part of private owners of the feasibility of forest regeneration and of the possibility of making the forest products industries permanent. This latter, in the opinion of the reviewer, calls for more trained men in private industry in the forestry and utilization fields. In the latter field much can be done toward closer utilization and the extension of the life of the old growth.

EMANUEL FRITZ,
University of California.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

Bibliography of Forest Industry Educational Materials. 12 pp. American Forest Products Industries, Washington 6, D. C. 1951.

Climbs in the Canadian Rockies. By F. S. Smythe. 260 pp. Illus. W. W. Norton, Inc., 70 5th Ave., New York 11. 1951. $4.50.

Pine Logs and Politics; A Life of Philetus Sawyer, 1816-1900. By R. N. Current. State Historical Society of Wisconsin, Madison. 1951. $4.

Red River Runs North! By Vera Kelsey. 297 pp. Harper & Bros., New York 16. 1951. $3.75.

Conservation

A Handbook for Teaching Conservation. By W. F. Clark and others. 66 pp. State Univ. of New York, College of Agriculture, Ithaca, N. Y. 1951. Mimeog.

In-Service Training in Conservation Education. By H. B. Ross. 15 pp. Illus. State Univ. of New York College of Agriculture, Ithaca, N. Y. Cornell Misc. Bul. No. 9. 1951.

Forest Management

An Annotated Bibliography of Aerial Photographic Applications to Forestry. By C. W. Garrard. 81 pp. State Univ. of New York College of Forestry, Syracuse, N. Y. Bul. No. 26. Mimeog. 1951.

Growth Tables for Selectively-Cut Ponderosa Pine in Western Montana. By A. L. Roe. 16 pp. Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Station Paper No. 32. 1951.

Forest Products

Christmas Trees—Their Profitable Production in West Virginia. By E. H. Tryon, and others. 28 pp. Illus. West Virginia Univ., Agric. Expt. Sta., Morgantown. Cir. No. 82. 1951.

Forest Resources

Lumber Production Maps for Southern Forest Survey Territory. By J. F. Christopher. 30 pp. Southern Forest Expt. Sta., New Orleans, La. Survey Release No. 68. 1951. Mimeog.

South Carolina's Forests. 23 pp. Illus. Forestry Committee of South Carolina, Columbia. 1951.

Logging and Milling

Empire in Pine: The Story of Lumbering in Wisconsin, 1830-1900. By R. F. Fries. 269 pp. Illus. State Historical Society of Wisconsin, Madison. 1951. $4.

Pathology

Oak Wilt in Michigan. By F. C. Strong. 7 pp. Illus. Reprint from Quarterly Bulletin of the Michigan Agric. Expt. Sta., East Lansing. August 1950.

Oak Wilt in Ohio: A Plan for Locating and Identifying the Disease. By H. C. Young. 4 pp. Illus. Ohio Agric. Expt. Sta., Wooster. Special Cir. No. 87. 1951.

What's Wrong with My Tree? By S. H. Davis. 12 pp. Illus. New Jersey Agric. Expt. Sta., New Brunswick. Cir. No. 540. 1951.

Protection

Cooperative Forest Fire Control. By J. B. Kling. 106 pp. State Univ. of New York, College of Forestry, Syracuse. Bul. No. 25. 1951. Mimeog.

Fire Behavior in Northern Rocky Mountain Forests. By J. S. Barrows. 103 pp. Illus. Northern Rocky Mt. Forest and Range Expt. Sta., Missoula, Mont. Station Paper No. 29. 1951.

Southern Pine Bark Beetles. 8 pp. Illus. South Carolina Commission of Forestry, Columbia. 1951.

Range Management

Cost Guides for Range Reseeding. By C. V. Plath. 14 pp. Oregon Agric. Expt. Sta., Corvallis. Cir. of Info. No. 497. June 1951. Mimeog.

Pine Forest Ranges in Louisiana. By J. T. Cassaday and R. S. Campbell. 7 pp. U. S. Forest Serv., Southern Forest Expt. Sta., New Orleans, La. 1951. Mimeog.

Renovation and Fertilization of Established Stands of King Ranch Bluestem [Antropogon ischaemum]. By R. C. Potts and others. 3 pp. Texas Agric. Expt. Sta., College Station. Progress Rept. No. 1371. May 18, 1951. Mimeog.

Research on the College Ranch; a Review of Results from Experiments in Range Management, Nutrition of Range Cattle, Beef Production. By J. H. Knox and others. 32 pp. Illus. New Mexico Agric. Expt. Sta., State College. Bul. No. 359. February 1951.

Reseeding Trials in a Sagebrush-Pinyon-Juniper Area in Western Colorado. By C. W. Doran. 3 pp. U. S. Forest Serv., Rocky Mt. Forest and Range Expt. Sta., Ft. Collins, Colo. Research Note No. 9. March 1951. Mimeog.

Silviculture

The Genetics of Southern Pine (A Preliminary Report). By K. W. Dorman. 52 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1950.

A Reproduction Study of Northern White Cedar; Including Results of Investigations Under Federal Aid in Wildlife Restoration Project Michigan 49-R. By T. C. Nelson. 100 pp. Illus. Game Div. Dept. of Conservation, Lansing, Mich. 1951.

Row-Thinning in a 14-Year Old Shortleaf Pine Plantation in Southern Illinois. By W. R. Boggess. 3 pp. Univ. of Illinois Agric. Expt. Sta., Urbana. Forestry Note No. 24. 1951.

Storing Southern Pine Seed. By P. C. Wakeley. 13 pp. Southern Forest Expt. Sta., New Orleans, La. Occasional Paper No. 123. 1951. Mimeog.

The Thinning of Pinus Radiata Plantations in the South-East of South Australia. By N. W. Jolly. 27 pp. Dept. of Woods and Forests, South Australia, Adelaide. Bul. No. 4. (Govt. Printer.)

Yellowpoplar: Reaction to Crown Release and Other Factors Influencing Growth. By Torkel Holsoe. 82 pp. Illus. West Virginia Univ. Agric. Expt. Sta., Morgantown. Bul. No. 344T. 1951.

Soils

Mineral Nutrition of Plants. By Emil Truog. 483 pp. Illus. Univ. of Wisconsin Press, Madison 5. 1951. $6.

Soil Survey Manual. 503 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. Agric. Handbook No. 18 (Supercedes Misc. Publ. No. 274 (1937). 1951. $3.

Wood Preservation

Principles of Wood Preservation; Their Application Under New Zealand Conditions. By J. H. Smith and D. R. Carr. 51 pp. Illus. New Zealand Forest Serv., Wellington. Info. Ser. No. 10. 1950. (R. E. Owen, Govt. Printer.)

Wood Technology and Utilization

Chemistry of Wood. By Eric Hägglund. 631 pp. Illus. Academic Press, Inc., New York 10. 1951. $13.50.

Insignis Pine; Its Use as a Building Timber. By J. S. Reid. 21 pp. New Zealand Forest Serv., Wellington. Info. Ser. No. 9. 1950. (R. E. Owen, Govt. Printer.)

Wood and War; Selected List of References. Comp. by L. E. Potter. 25 pp. State Univ. of New York, College of Forestry Library, Syracuse. 1951. Mimeog.

Society Affairs

Compiled by ROBERT D. HOSTETTER, *Assistant Executive Secretary*

Your S. A. F. Officers, Council, and Staff Wish You A

Merry Christmas and a Happy New Year!

Charles F. Evans	*Clarence S. Herr*	*Henry E. Clepper*
Frederick H. Brundage	*C. Otto Lindh*	*Robert D. Hostetter*
D. B. Demeritt	*Gordon D. Marckworth*	*Albert G. Hall*
Stanley G. Fontanna	*Richard E. McArdle*	*L. Audrey Warren*
Frank H. Kaufert	*DeWitt Nelson*	*Lloyd Thorpe*
	Earl Porter	

Evans Anticipates Record Meeting

President Charles F. Evans says that indications point toward a new annual meeting record when foresters converge on Biloxi, Miss. for the December 11-15, 1951 convention of the Society of American Foresters. Attendance at the Golden Anniversary Meeting in Washington, D. C. was 1,250. Over 800 registered for the 1949 meeting in Seattle, and 600 attended the 1948 meeting in Boston.

Field trips, meetings of the Society's 11 professional Divisions, emphasis of "Southern Forests—Past, Present, and Future" in the general sessions, a "seafood jamboree" dinner, and gatherings of related organizations are features of the 1951 annual Society meeting.

Corrections

These institutions which offer introductory and specialized courses in forestry should have been listed as follows on page 672 of the September 1951 JOURNAL OF FORESTRY:

University of Arkansas, F. M. Meade, Department of Horticulture, Fayetteville, Arkansas.

Centenary College of Louisiana, R. R. Speirs, Jr., Department of Biology, Shreveport, Louisiana.

Paul Smith's College, William Rutherford, Forestry Department, Paul Smiths, New York.

University of the South, Charles E. Cheston, Department of Forestry, Sewanee, Tenn. offers a four-year undergraduate course. It too should have been listed.

Dues Deductible on Income Tax Reports

Members will have at least one comforting thought during the coming income tax season if they remember that Society dues may be classified as deductible expenses in filing income reports. The total amount of dues paid may be deducted.

During the later part of November the Society office mailed dues memorandums to the 8,000 members of the Society. Prompt payment of dues allows the Society to budget more realistically and reduces the expense of successive billings. It also enables Society members to lessen the period during which they are without a membership card for the current year. Although members have until June 30 to pay dues and still remain in good standing, prompt payment is urged.

Canadian members may pay their dues in Canadian funds. All subscriptions to the JOURNAL OF FORESTRY must be paid in U. S. funds.

Coming Events

Allegheny Section

The Allegheny Section will meet on February 14, 15, 16, 1952 at Pittsburgh, Pa.

Appalachian Section

The Appalachian Section will meet in Raleigh, N. C. on January 18 and 19, 1952. A. E. Wackerman is in charge of arrangements and William Maughan will plan the program.

Sections Develop Aids for Effective Administration

How to effectively conduct the activities of their administrative units is the major assignment of more than 150 Society members currently serving as Section chairmen, vice chairmen, and secretary-treasurers; Chapter chairmen; and Section representatives at the accredited forestry schools.

To carry out their responsibilities they and their predecessors have developed a number of aids. Among these is a Section Manual containing information on the Society's objectives and organization, membership procedures, rules of order, the Code of Ethics and the Constitution, and reference material useful in planning and conducting meetings and other activities. Forums at which Section officers can exchange ideas and discuss methods of improving the functioning of Sections have also proven useful to Section leaders. These are held at the time of national meetings. And of course Section officers have the precedents and files of their predecessors to guide them.

An aid to Section officials that is probably as great as any is the understanding by the members of their officers' responsibilities. These responsibilities include planning and conducting Section meetings, field trips, projects, and other activities. Each member has the opportunity to cooperate with his Section and Chapter officers in describing the work of the Section to the public, in telling eligible

non-members of the benefits and responsibilities of Society membership, and in sharing his knowledge with other foresters.

An understanding of the Section-Society working relationships by all members is invaluable. As a matter of general information to all members and as a preview for future Section officials, some general procedures are listed here.

The Society office assists the Sections in maintaining up-to-date files of Section membership by providing Section secretaries with 3 by 5 inch cards allowing file revisions necessitated by changes of address, transfers between Sections, new members, advancements in grade, and terminations. Upon notifying the Society office of changes of address, members are automatically transferred from one Section to another.

Section dues are collected from Society members by the Society office which then turns the money over to the Sections.

All applications for election or advancement to the Affiliate, Associate, Member, or Junior (Class B) grades must be approved by the Section in which the candidate resides. Such membership transactions are handled by the Section's membership chairman. Graduates of approved curricula in accredited forestry schools who are eligible for Junior Membership, Class A, and who weren't Student Members, submit their applications direct to the Society office.

Communiques to Sections from the Society office are issued from time to time to keep Section and Chapter officials informed on national Society affairs.

All papers presented at Section meetings should be submitted to the editor to be considered for publication in the JOURNAL OF FORESTRY.

It is the responsibility of Section secretaries to notify the Society office of forthcoming Section meetings as far in advance as possible and to submit a brief report of meeting, with photographs if available, for publication in Society Affairs.

Student Member Grade Incites Good Response

Response to the Student Member grade by forestry students has been good, acording to Section representatives at the accredited forestry schools. The Student Member grade was inaugurated in January 1951 following a referendum to revise the Constitution, providing for the participation of forestry students in the Society.

Last spring 678 forestry students were elected to the Student Member grade. Sixty-three percent of these—424 seniors and 16 graduate students—were advanced to the Junior grade last summer.

The 424 seniors who were Student Members represented 40 percent of the 1,063 seniors who were eligible for Student Membership. Table 1 shows the proportion of eligible senior students at each of the 23 undergraduate accredited forestry schools who became Student Members.

The membership goal last spring at each school was 50 percent of the eligible seniors. Schools which achieved the goal were Alabama Polytechnic Institute, University of California, University of Georgia, University of Masachusetts, Michigan State College, University of Minnesota, Oregon State College, Purdue University, and University of Washington. The same goal is being continued during the 1951-52 school term in an effort to raise the national average from last term's 40 percent to the 50 percent goal. Greatest rivalry among schools, however, is to achieve the membership of 100 percent of the eligible students. Several schools are already well on the way toward that objective this year, according to Robert D. Hostetter, assistant executive secretary. Applications are landing in the Society office like a pink snowstorm, he says. More than 125 were received during October.

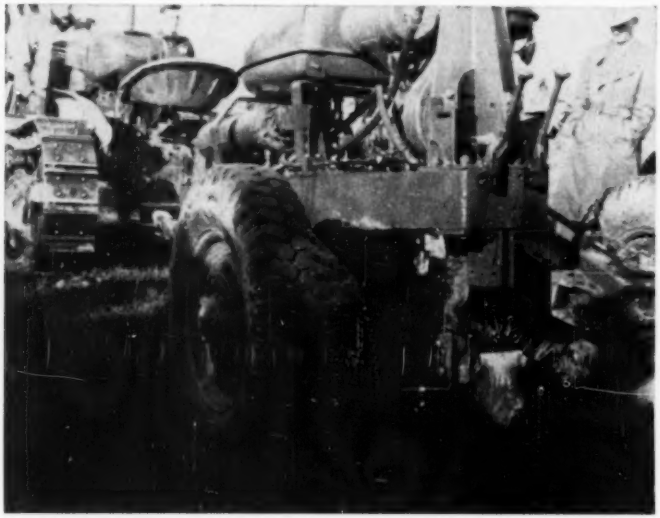
Students enrolled in 41 of the 75 curricula offered by schools of natural resources and schools of forestry at the 25 institutions accredited by the Society to provide instruction in professional forestry are eligible for Student Membership. Such students last year represented 70 percent of the total enrollment. To qualify for Student Membership, students must be juniors or seniors enrolled in curricula which contain the basic forestry courses prescribed by the Council. Graduate students, if not already eligible for the Junior Member grade, also may become Student Members. Upon graduation, Student Members are automatically advanced, if there are no protests, to the Junior Member grade. Upon acquiring three years of forestry experience following graduation, Junior Members may apply for advancement to the Member grade.

TABLE 1.—STUDENT MEMBERS (SENIORS) AT UNDERGRADUATE ACCREDITED FORESTRY SCHOOLS, SPRING 1951

Institution	Number of senior forestry students elected to Student Member grade, January through June 1951	Number of Student Members in senior year, expressed as percentage of total number of senior forestry students eligible for Student Membership, January through June 1951
1. Alabama Polytechnic Institute	17	100
2. University of California	34	50
3. Colorado A & M College	9	25
4. University of Florida	4	11
5. University of Georgia	19	100
6. University of Idaho	10	20
7. Iowa State College	14	21
8. Louisiana State University	14	36
9. University of Maine	10	29
10. University of Massachusetts	4	57
11. Michigan State College	30	91
12. University of Michigan	22	26
13. University of Minnesota	23	50
14. University of Missouri	6	22
15. Montana State University	20	31
16. State University of New York	34	43
17. North Carolina State College	13	31
18. Oregon State College	41	55
19. Pennsylvania State College	19	22
20. Purdue University	20	59
21. Utah State Agricultural College	10	42
22. University of Washington	35	66
23. West Virginia University	14	31
Totals	424	40

Central States Members See Scalping Machine

A tractor-drawn machine that scalps the sod from a space in which a tree is to be planted was observed on a field trip taken by 125 foresters attending the annual meeting of the Central States Section on October 18, 19, and 20, 1951. The scalper was demonstrated by forester Ted Daw of the Michigan Department of Conservation which has developed and built six of the machines.



The group also visited the Rifle River Project, which is a management program involving all resources on an entire watershed. Other points of interest on field trips included plantation thinning plots, controlled burning for grouse management, an archery company, a log cabin factory, and various examples of forest management practices. Norman F. Smith was in charge of the program and arrangements for the meeting.

At a business meeting the Section revised its policy regarding its annual awards to the outstanding forestry senior at Michigan State College, University of Michigan, and Purdue University. In the future each recipient (who must be a Student Member) will receive a tie chain with S.A.F. emblem pendant and the payment of his Junior Member dues for one year.

The group also discussed the registration of professional foresters. The Lower Michigan Chapter had on October 18 favored action to secure enactment of legislation to provide for registration in Michigan. Refinement of a proposed bill is now in progress. A similar proposal is being considered in Illinois.

Irving I. Dickman, Section vice chairman and membership chairman, announced that the Central States Section showed the greatest increase in membership among all the Sections during the preceding year, having advanced from eighth to fourth place.

Two motions to provide contributions by the Section to finance Chapter activities failed.

Wallace Gunderson won the Indian fire pump door prize contributed by D. B. Smith and Company.

A memorial resolution honoring W. F. Ramsdell who died in September was passed by the Section.

Big game hunting in Europe and legislative proposals affecting forestry that resulted from the Hoover commission report were the respective topics of talks by a member of the Michigan Conservation Commission and Samuel T. Dana, School of Natural Resources, University of Michigan.

Officers installed on October 19, 1951 for the current year are: Irving I. Dickman, chairman, Ohio Division of Forestry, 1500 Dublin Road, Columbus 12, Ohio; Ralph W. Lorenz, vice chairman and membership chairman, Department of Forestry, 222 Mumford Hall, University of Illinois, Urbana, Ill.; and Robert Craig, secretary-treasurer, School of Natural Resources, University of Michigan, Ann Arbor, Mich.

New York Section Meets at Saranac Lake

About 125 members of the New York Section participated in a two-day summer meeting held at Saranac Lake on September 13 and 14, 1951.

The meeting featured several field trips to forest areas in the vicinity that suffered great damage from blow-down by the storm of November 25, 1950. A particularly heavily damaged area near Axton was visited under the auspices of the New York State Conservation Department. This area had been closed for some time due to the fire hazard.

Discussions in the field, led by specialists concerned salvage operations, effects of blow-down on game management, forest fire control measures, recreational use, and tree pest problems.

Another feature of the two-day conference was the description of the Adirondack-Catskill Forest survey project being completed this year by field crews of the State University of New York College of Forestry for the State Board of Equalization and Assessment. James E. Davis and Miles J. Ferree of the college staff explained the organization and techniques used in collecting the voluminous data on the Adirondack forest area. Allen W. Bratton, forester for the State Board of Equalization and Assessment, described the application and use of the data in determining equitable forest land values.

A brief business meeting, with Chairman A. J. Woodford presiding, was also held during the morning of the second day.

On the evening of the first day a banquet of turkey and brook trout was enjoyed at the Hotel Saranac with John Stock as toastmaster. An inspiring and challenging talk was given by Wheeler Milmoe, assemblyman and chairman of the joint legislative committee on natural resources. Demonstrations by a magician, the awarding of door prizes, and showing of colored motion pictures of the storm damage to timberland in the area concluded the banquet program.

Five committees on arrangements operated under the direction of co-chairman Jean E. Fisher of the College of Forestry staff and Esmond W. Sears of the Conservation Department's Saranac Lake office.

R. G. UNGER, *Chairman,*
Public Relations Committee,
New York Section.

Section Schedules Radio Programs

Because it illustrates the results in public relations which can be achieved by a Section, the following committee report is published in full. It was prepared by James Stevens, chairman of the Publicity Committee, Puget Sound Section. It covers the 1950-1951 meeting season.—*Editor.*

Publicity Chairman's Report

Publicity for the Section in the past year was hooked mainly on radio, with monthly news releases to the press. The joint meeting of the Section with the annual Governor's Keep Washington Green meeting was a public relations arrangement for both groups.

Seattle's radio station KJR, outlet for the American Broadcasting Company, accepted a Section proposal last fall for a series of radio broadcasts. This was in the face of competition from many strong groups with good causes to promote. Only a small amount of time is available from any major radio station for non-commercial, public-service programs.

The Washington Education Association with 17,000 public school teachers and officials as members, joined with the Section in the KJR project. Section member C. Montgomery Johnson is WEA public relations director. He saw the opportunity for both organizations in the KJR program and WEA executive secretary Joe A. Chandler and Washington Education JOURNAL editor Albert E. Gerritz took the same view. Their cooperation has been invaluable, not only in the program itself, but in the generation of a more informed interest in conservation education among teachers. Mr. Johnson has become the star moderator of the *Green Gold* program, which is now heard weekly on KJR, 5:00 to 5:15 p.m. on Saturday.

On each program an educator and a forester are led by a moderator on a "casual, informal discussion" of a Washington forestry theme and its relation to public education.

Four programs were tape-recorded before the first broadcast on January 6, 1951, on which Pearl Wanamaker and Bernard Orell discussed "The State's Stake in Forestry." On January 13, Bill Tinney, who as Section chairman worked most effectively on both the arrangement and production of *Green Gold* programs, was at the microphone with Ernest Edgerton, high school science teacher. January 20, with C. M. Johnson moderating, WEA executive secretary Joe A. Chandler and Howard Johnson, supervisor of Snoqualmie National Forest, talked on the theme, "Schools and the National Forests." Then came Dean Gordon D. Marckworth and botany teacher Harry Lemon; Allen Thompson and science educator Fred Rantz; George L. Drake and Shelton schools superintendent R. W. Oltman; White River district ranger R. Nevan McCullough and high school principal Don Bunt. Howard Brier, director of Keep Washington Green, and William A. Eastman, Jr., took turns with Tinney and Johnson as moderators. Eastman was the year's chairman of the Seattle Chamber of Commerce's forestry committee.

The management of KJR has been glad to keep the program going past the 16 that were proposed as a trial run. At an early date the good Saturday late afternoon spot was given *Green Gold*. Saturday, October 6, is the date of the 40th program. This means 120 voices talking through ten hours over a major radio station of Washington State, on forestry.

In conclusion, two motions are offered:

A motion authorizing the chairman of the Puget Sound Section, SAF, to write Mr. Arch Morton, manager of radio station KJR, Seattle, expressing the appreciation of the Section's membership for the *Green Gold* radio program and promising cooperation in its continuance;

A motion authorizing the Section chairman to thank the Washington Education Association, in the name of the Section membership, for cooperation in the *Green Gold* radio program and asking its continuance.

It has been a privilege and a pleasure for your publicity chairman to serve the Section through the past year and to work with publicity committee members Fremont McComb, Gene Hofstead, William J. Sauerwein, Albert Arnst, Edward Anderson, and Bob Fuller.

It is the urgent recommendation of the retiring publicity chairman that the reorganization of county Keep Washington Green Committees be made the No. 1 public relations objective of the Puget Sound Section in the year ahead.

Respectfully submitted,

JAMES STEVENS, *Chairman,*
Publicity Committee,
Puget Sound Section.

Curriculum Content Discussion Continues

Herbert O. Fleischer's statement, which follows, is another contribution to the subject under discussion for the past several years concerning the scholastic accomplishments which qualify an individual as a professional forester. A forum treating this matter is the principal feature of the Society Affairs session of the Society's annual meeting held in Biloxi, Miss. on December 11 to 15, 1951.

When Is A Wood Technologist A Forester?

As a forester who has been active in wood technology research for the past ten years, I have been alarmed at the rift that appears to be developing in our ranks because of the educational requirements for membership in the Society.

There has been some objection to requiring study of general forestry subjects by students specializing in wood technology (JOURNAL, May 1951). Specialization in wood technology requires a limited knowledge of economics, engineering, chemistry, and physics, and only a minimum knowledge of general forestry subjects. Logically, therefore, wood technologists could be trained in our university engineering schools, or in our chemistry departments, as well as in our forestry schools. Nevertheless the forestry schools have taken the bull by the horns and have established utilization departments, whose primary purpose is to train foresters in the specialized knowledge of wood technology. No doubt the great majority of our practicing wood technologists of the future will stem from this source.

I believe that it is essential to the welfare of our profession that the development of wood technology as a branch of forestry be encouraged. As Professor Hawley pointed out in an article on the relationship between forest utilization and forest management in the JOURNAL for August 1951, the number one job of the utilization expert, in the American forestry scene, is to find uses for the small material, the poorer trees, the less valuable species, the defective and at present unmarketable portions of trees. If the wood technologist fails to measure up to this assignment, he has missed his goal. If he does not take into account the changing nature of the available wood resource, he cannot contribute his share in the development of sound forestry in America.

During the past year I have had opportunity to work on the utilization of Douglas-fir timber containing "white pockets" caused by the action of *Fomes pini*. It appears that logs so affected have a considerable salvage value, and it is possible that the material may be used for a wide variety of products. Yet I encountered one wood technologist—and in this case I am referring to an engineer who had been working in the wood technology field for many years—who would have nothing to do with this defective material. This man was an engineer at heart, thinking of materials in terms of mechanical perfection. He did not think, as a forester would, of the more basic problem of bringing land

January Issue Carries Election Results

All Section officers were immediately notified of the results of the December 1, 1951 Society election, and they passed the word to many other persons, but the remaining members may not learn the news until they see it in the January JOURNAL OF FORESTRY. Copy deadlines did not allow publication of the results in the December issue.

Photographs of the new president, vice president, and nine other newly elected Council members will be published in the January issue. It is also planned to publish the photographs of the eminent Members who were advanced to the grade of Fellow on December 1, 1951.

now being occupied by overmature timber back into production, by finding methods of salvaging a material of limited usefulness.

It should be clear from this illustration that there may be great differences among wood technologists, depending upon training and background. Only the man with the forestry background will look upon his work as an aid to good forestry. Only he can realize the immense implications of his work in making possible good silviculture, and in sowing the seeds of wise conservation of natural resources.

With this in mind, the Society should make every effort to bring qualified wood technologists into its membership. Compromise, if necessary. Make what concessions are needed to encourage the development of good wood technology departments at our forestry schools. Those in charge of utilization training, on the other hand, should urge their students to go beyond the five so-called basic forestry courses, and to expose themselves to forest history and policy; to learn about the early struggles to establish forestry as a profession in America. Their objective must be to train men who will be not only wood technologists but also foresters. This they can accomplish only if they teach their students to understand their part in the overall objective of "good conservation through wise use."

HERBERT O. FLEISCHER,
Madison, Wis.

Candidates for Membership

Candidates for admission (except those for the Student Member grade), advancement, or reinstatement whose membership applications were received in the Society office during the month of October are listed below.

Action regarding the eligibility of these candidates will be taken by the Council as of January 1, 1952. Any communications from voting members relating to the membership eligibility of any of these candidates should be received in the Society office prior to that date.

The names of these candidates who become members of the grades for which they have applied will be published in subsequent issues of the JOURNAL OF FORESTRY.

Allegheny Section

Junior Grade

Azzato, R. A., 283 N. St. Marys St., St. Marys, Pa.; Pa. State, B.S.F., 1950.
Drobile, R. J., Topographic Engr., U. S. Geological Survey, Philadelphia, Pa.; Pa. State, B.S.F., 1951.
Kantz, B., Star Route, Selinsgrove, Pa.; Pa. State, B.S.F., 1951.

Appalachian Section

Junior Grade

Brown, W. L., Dacusville, S. C.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Diehl, P. B., Forester, U. S. Gypsum Co., Altavista, Va.; Pa. State, B.S.F., 1951.
Shaw, M. N., Jr., County Forester, N. C. Forest Service, Lexington, N. C.; N. C. State, B.S.F., 1949.

Member Grade

Applefield, M., Cons. Forester, Jacksonville, N. C.; N. Y. State, B.S.F., 1938; Duke, M.F., 1951.

Central Rocky Mountain Section

Junior Grade

Cheatham, J. L., Forester, State of Colorado, Gould, Colo.; Colo. A & M., B.S.F., 1951.

Central States Section

Junior Grade

Cooley, J. R., Box 16, Corunna, Mich.; Univ. of Mich., B.S.F., 1951.
Moehler, M. A., 4569 N. Meade Ave., Chicago, Ill.; Iowa State, B.S.F., 1951.
Schmeling, R. E., Mgr. Woodlands Dept., Mead Corp., Escanaba, Mich.; Mich. State, B.S.F., 1941; M.F., 1942.
Schooley, C. M., Forester, Mich. Dept. of Cons., Roscommon, Mich.; Univ. of Mich., B.S.F., 1949; M.F., 1949.
Whittemore, D. K., 112 South Washington, Ypsilanti, Mich.; Mich. State, B.S.F., 1951.

Member Grade

McCraw, W. E., Logging Engr., Caterpillar Tractor Co., Peoria, Ill.; Univ. of Toronto, B.S.F., 1928. (Junior 34R49).
Van Alsburg, J. F., Cons. Forester, 573 Elmdale Court, Holland, Mich.; Univ. of Mich., B.S.F., 1936; M.F., 1936. (Junior 36R46).

Associate Grade

Radcliffe, B. M., Asst. Prof. of Forestry, Purdue Univ., Lafayette, Ind.; Purdue Univ., B.S.M.E., 1948; M.S.E., 1951.

Columbia River Section

Junior Grade

Karlinger, E. M., Tbr. Sale Work, U.S.F.S., Roseburg, Oreg.; Oregon State, B.S.F., 1951.
Swan, R. E., Forestry Aide, U.S.F.S., Cave Junction, Oreg.; Colo. A & M., B.S.F., 1951; M.F., 1951.

Member Grade

Griffith, G. C., Forester, Pope and Talbot, Inc., Oakridge, Oreg.; Oregon State, B.S.F., 1947. (Junior, 1948).

Affiliate Grade

Healy, R. S., Forester, Bureau of Land Mgmt., Roseburg, Oreg.; Wash. State College, B.S.A., 1950.

Gulf States Section

Junior Grade

Adams, M. C., Flight Instructor, Calif. Eastern Airways, Columbus, Miss.; Mont. State, B.S.F., 1949.
Dykes, J. F., Forestry Agent, Ill. Central Railroad, Baton Rouge, La.; La. State Univ., B.S.F., 1949.

Affiliate Grade

Butler, I. H., Area Supv., Brown Paper Mill Co., Inc., West Monroe, La.
Corry, W. B., Unit Supv., Brown Paper Mill Co., Inc., West Monroe, La.

New England Section

Junior Grade

Burgess, S. L., Farm Forester, State of Maine, Augusta, Maine; Univ. of Maine, B.S.F., 1947.
Ganley, R. V., North Pleasant St., Amherst, Mass.; Univ. of Mass., B.S. (Forestry), 1950; Duke, M.F., 1952.
Macomber, E. E., Farm Forester; Maine Forest Service, Bangor, Maine; Univ. of Maine, B.S.F., 1951.
Macrigeanis, S. N., 546 Central St., Manchester, N. H.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Whitney, H. E., Dendrician, Bartlett Tree Expert Co., Danbury, Conn.; Univ. of Maine, B.S.F., 1951.

Member Grade

Shepard, H. M., Asst. Mgr., Eastern Pulp Wood Co., Calais, Me.; Univ. of Me., B.S.F., 1946. (Junior, 1951).
Young, J. A., Forester, Eastern Pulp Wood Co., Calais, Me.; Univ. of Me., B.S.F., 1947. (Junior, 1947).

New York Section

Junior Grade

Peterson, D. W., 139-20 225th St., L. I., N. Y.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Weinheimer, A. J., Forester, (self-employed), Old Chatham, N. Y.; N. Y. State, B.S.F., 1941.

Northern California Section

Junior Grade

McNie, J. C., Forester, Mich.-Calif. Lbr. Co., Camino, Calif.; Oregon State, B.S.F., 1951.

Member Grade

Noskowiak, A. F., Park Rgr. Naturalist, Glacier Nat'l. Park, Mont.; Univ. of Calif., B.S.F., 1942; M.F., 1949. (Junior, 1944).
Ramstad, G. I., Dist. Rgr., U.S.F.S., Pine Grove, Calif.; Univ. of Wash., B.S.F., 1936. (Reinstatement).

Ozark Section

Junior Grade

Shaw, D. L., Asst. Instructor, Univ. of Mo., Williamsville, Mo.; Univ. of Mo., B.S.F., 1951.
Ward, J. T., Box 88, Hamburg, Ark.; Univ. of Mo., B.S.F., 1951.

Affiliate Grade

Beene, J. T., Soil Cons., Camden, Ark.; Ark. A & M., B.S., (Forestry), 1951.

Puget Sound Section

Junior Grade

Bush, Y. A., Forest Engr., (self-employed), 7542 33rd Ave., N.W., Seattle, Wash.; Univ. of Wash., B.S.F., 1937.
Harrison, H. A., Forester, U.S.F.S., Seattle, Wash.; Univ. of Wash.; B.S.F., 1935.
Mohundro, W. M., 2920 Alki Ave., Seattle, Wash.; Univ. of Wash., B.S.F., 1951.

Member Grade

Greenwood, P. S., Yard Supt., West Tacoma Newsprint Co., Steilacoom, Wash.; Univ. of Wash., B.S.F., 1946. (Junior, 1947).

Southeastern Section

Junior Grade

Carter, V. E., 1023 Oconee St., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Craven, F. E., Box 158, Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Dean, C., 107 Woodrow St., Athens, Ga.; Univ. of Ga.; B.S.F., 1951. (Student, 1951).
Godfrey, E. M., Forester, St. Joe Paper Co., Port St. Joe, Fla.; Univ. of Fla., B.S.F., 1942.
Hardy, J. H., Box 353, Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Hutchinson, E. L., Univ. Courts, Athens, Ga.; Univ. of Ga.; B.S.F., 1951. (Student, 1951).
James, K. E., Box 342, Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Kreis, E. A., 439 N. Highland Ave., N.E., Atlanta, Ga.; Univ. of Ga.; B.S.F., 1951. (Student, 1951).
Langley, J. H., Route No. 5, Ellijay, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Livingston, G. M., Jr., Route No. 3, Bainbridge, Ga., Univ. of Ga., B.S.F., 1951. (Student, 1951).
Mordecai, C. R., Jr., Univ. Courts Apts., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Murray, B. R., Box 138, Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Patterson, J. R., 105 Stone Rd., Greenville, Ala.; A.P.I., B.S.F., 1950.
Santoro, J. C., 757 E. Duffy St., Savannah, Ga.; Univ. of Mass., B.S., (Forestry), 1950; Duke, M.F., 1951.
Smith, F. A., County Forester, Adel, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Wall, J. H., Univ. of Ga., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).
Williams, O. L., 112 N. Erwin St., Cartersville, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Affiliate Grade

McClure, C., Chief Forester, Allison Lbr. Co., Bellamy, Ala.; A.P.I., B.S., (Science and Literature), 1932.

Southwestern Section

Junior Grade

Duran, G., Jr., Forester, U.S.F.S., Taos, New Mexico; Colo. A & M., B.S.F., 1951.
Hodgin, F. M., Forester, U.S.F.S., Holbrook, Ariz.; Colo. A & M., B.S.F., 1932. (Reinstatement).
Nevein, K. H., Fire Control Aide, U.S.F.S., Taos, New Mexico; Iowa State, B.S.F., 1949.
Sahlin, K. W., Forestry Aide, U.S.F.S., Taos, New Mexico; Univ. of Minn., B.S.F., 1951.
Swetnam, F. R., Fire Control Aide, U.S.D.A., Taos, New Mexico; Colo. A & M., B.S.F., 1950.

Member Grade

Cravens, J. H., Forester, Coconino Nat'l. Forester, Flagstaff, Ariz.; Colo. A & M., B.S.F., 1947; M.F., 1948. (Junior, 1949).

Affiliate Grade

Johnson, R. C., Forester, Santa Fe Nat'l. Forest, Santa Fe, New Mexico; New Mexico A & M, B.S.A., 1936.

Upper Mississippi Valley Section

Junior Grade

Morgan, R. L., Asst. Habitat Development Leader, North Dakota Fish and Game Dept., Minot, N. Dakota; Iowa State, B.S.F., 1951.
Readinger, E. H., Guthrie Center, Iowa; Iowa State, B.S.F., 1951. (Student, 1951).

Washington Section

Junior Grade

Carson, W. G., Army Map Service, Washington, D. C.; N. Y. State, B.S.F., 1951.
Lochtefeld, J. V., No. 1 Tulane Ave., Glen Echo, Md., Univ. of Mich., B.S.F., 1951.

Affiliate Grade

Thompson, G. A., Cartographic Aide, Navy Hydrographic Office, Suitland, Md.; Okla. A & M., B.S.F., 1951.

Wisconsin-Upper Michigan Section

Affiliate Grade

Logan, G. L., Forester, Marathon Paper Mills of Canada, Ltd., Hearst, Ontario, Canada; Univ. of Toronto, B.S., (Forestry), 1951.

Foreign

Member Grade

Shulley, F. J., Economic Adviser, UNCACK, 8201 AU, 8th Army, Seoul, Korea; Pa. State, B.S.F., 1922; Yale, M.F., 1924. (Reinstatement).

New Members and Advancements

Individuals who became members of the grades indicated during the month of October are listed below. They are eligible for participation in activities of the Society of American Foresters, including meetings and projects of Sections, Chapters, Divisions, and Committees.

Allegheny Section

Student Grade

PENNSYLVANIA STATE COLLEGE

Horner, R. E.
Horsmon, F. M.
Hoyer, G. E.
Kronk, M.E.
Shrauder, P. A.
Wagner, J. F.

Junior Grade

Best, H. C., 741 Poplar St., Williamsport, Pa.
Cadman, W. B., 1123 Isabella St., Williamsport, Pa.
Merck, H. L., 728 West 17th St., Huntington, W. Va.
Penniman, E. C., Socony Vacuum Eastern Pipe Line, Plainfield, N. J.
Szpak, C. A., Jr., 819 N. First St., Lehighton, Pa.
Wendel, G. W., 208 E. Cliff St., Somerville, N. J.

Appalachian Section

Student Grade

DUKE UNIVERSITY

Winters, E. J.

Junior Grade

Besse, J. D., N. C. State College, Raleigh, N. C.
Schmidt, A. N., Fairfield Forest Products Co., Newberry, S. C.
Ward, M. F., 2117 Sheffield Rd., Raleigh, N. C.

Member Grade

Cowger, R. D., Harrisonburg, Va.
Milliken, W. F., Williston, S. C.

Affiliate Grade

Bell, E. W., Pritchardville, S. C.

Associate Grade

Orrell, C. D., c/o Federal Land Bank of Columbia, Columbia, S. C.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Griffith, T. L.

Junior Grade

Mortensen, J. M., Box 218, Yankton, S. Dakota.

Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Della-Bianca, L.
Ditzhazy, J. A.
Drury, H. P.
Gebben, R. A.
Hemerling, H.W.
Karsten, N. J.
Laverdiere, R. J.
List, J. R.
Marty, R. J.
Mercker, R. C.
Osborne, C. E.
Phillips, E. C.
Silver, S. O.
Toth, L. L.
Wagner, W. C.

UNIVERSITY OF MICHIGAN

Anderson, P. A.
Clifford, R. V.
Heath, M. W., Jr.
Heinz, R. E.
Herrmann, R. A.
Kunesh, R. H.
McQuinn, T. C.
Miller, S. R.
Phillips, J. F.
Smith, B. E.
Smithberger, T. J.
Whitmore, R. A., Jr.
Williams, H. J.

PURDUE UNIVERSITY

Forst, P. P.
Hartig, R. R.
Hromada, C. J.
Percival, D. H.
Phelps, R. C.
Radich, G. J.
Wommack, D. E.
Youngren, H. L.

Junior Grade

Imfeld, D. A., 4063 North Adams, Indianapolis, Ind.
Stage, A. R., 411 Longshore Drive, Ann Arbor, Michigan.

Member Grade

Preston, R. J., General Forester, Ohio Edison Co., Akron, Ohio.

Columbia River Section

Junior Grade

Dawson, F. S., 935 S. 5th St., Coos Bay, Oreg.
Hall, J. E., Box 124, Sprague River, Oreg.
Links, T. A., 1234 Winsor, North Bend, Oreg.
Posekany, R. L., General Delivery, Reedsport, Oreg.

Member Grade

Hummel, D. L., 3857 Boardman, Klamath Falls, Oreg.
Milius, H. C., Box 331, Bend, Oreg.
Prahar, L. B., 300 N. Jefferson St., Eugene, Oreg.

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Alison, T. W.
Foster, R. C.
Hamm, M. F.
Hatchell, G. E.
McCain, E. A.
O'Neal, J. P.
Snyder, W. C.

Junior Grade

Barrett, C. D., 401 Wilson St., Philadelphia, Miss.
DeGrummond, E., Jr., 812 21st St., Laurel, Miss.
Follen, W. F., Box 1422, Jackson, Miss.
Loe, W. A., Quitman, La.
Miller, R. R., 523 Avenue E., Bogalusa, La.

Member Grade

Burns, J. D., Box 107, Joyce, La.

Affiliate Grade

Freeman, J. E., Box 116, Natchitoches, La.
Nibert, J. M., c/o Keith Cranston and Asso., Leland, Miss.

Associate Grade

Lay, D. W., Box 106, Buna, Texas.

Kentucky-Tennessee Section

Junior Grade

Barlow, K. J., 1873 Harke Ave., Cleveland, Tenn.

New England Section

Student Grade

UNIVERSITY OF MAINE

Buchanan, J. W., Jr.
Connolly, R. A.
Dickson, T. L., Jr.
Dutton, A. L., Jr.
Geerinck, P. A.
Getchell, W. A.
Maple, W. L.
Moir, H. D., Jr.
Ouellette, D. J.
Phelon, R. F.
Roberts, C. M., Jr.
Roberts, H. B.
Rose, L. E.
Wave, H. E.
Wentworth, D. F.

Junior Grade

Banusevich, F. J., c/o Paris Mfg. Co., West Milan, N. H.
Boris, A. J., 1 Eames Ave., Worcester, Mass.
Poppema, D. R., Hastings House, Newport, N. H.

Member Grade

Campana, R., Yale Forestry School, New Haven, Conn.
Pauley, S. S., Harvard Forest, Petersham, Mass.
Schrack, R. A., 1704 Main St., West Warwick, R. I.
Schubert, B. L., Jr., 6 Chandler Rd., Andover, Mass.
True, R. M., 22 Hillis St., Portland, Me.
Wing, G. E., 56 Benton Ave., Waterville, Me.

New York Section

Junior Grade

Burt, R. H., Box 93, Elizabethtown, N. Y.
Gill, R. C., 375 Buffalo St., Gowanda, N. Y.
Hibbard, W. F., Jr., Oval Wood Dish Corp., Tupper Lake, N. Y.
Palmer, J. W., Round Lake, N. Y.

Member Grade

Adolph, R. D., 44 Rose Park, Highland Falls, N. Y.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Bourgeois, P. A.
Brown, R. L.
Charter, W. G.
Gladish, E. N.
Krohn, R. F.
Kyer, G., Jr.
Mace, R. B.
McCallum, W. B.
McFarland, F. E.
Menkens, H. E.
Muir, R. J.
Nicholson, J. E.
Steely, J. W., Jr.

Affiliate Grade

Bayles, W. P., 1607 Third St., Susanville, Calif.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Aikens, R. E.
Beck, P. L.
DeMoor, J. F.
Eggers, K. W.
Gann, A. L.
Grisham, E. W.
Hankins, R. T.
Hubbs, O. W.
Oechsle, E. H.
Ottomeyer, D. J.
Pallo, F. B.
Schores, D. D.
Ward, R. L.

Junior Grade

Allen, L. A., 681 N. Forest Ave., Webster Groves, Mo.

Affiliate Grade

Herron, Q. H., Box 511, Idabel, Okla.
Richards, E. G., 400 W. 9th, Crossett, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Buchanan, J. L.
Burr, A. L., Jr.
Davidson, R. A.
Fournier, E. A.
Hendrickson, J. P.
McGowan, J. R.
Mollett, O. D.
Nelson, J. W.
Power, A. D.
Sheldon, J. G.
Vail, S. A.
Van Fleet, D. M.
Wilson, C. N.

Junior Grade

Scheider, E. C., 212 S. 4th St., Yakima, Wash.
Taylor, D. J., Box 621, Olympia, Wash.

Member Grade

Guyon, D. A., Doty, Wash.
Mavor, F. D., 13039 9th Ave., N.W., Seattle, Wash.
Rheinberger, R. E., Port Gamble, Wash.

Affiliate Grade

O'Donnell, A. R., Box 895, Port Orchard, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

Bauerband, R. L.
Bray, W. D.
Dingus, B. J.
Duke, L. M.
Middlebrooks, B. S.
Nash, R. N.
Radford, A. L.
Schultz, W. J.
Tanner, E. G.
Thompson, J. E.
Walker, W. W., Jr.
Webb, C. H.
Welch, W. L.
Womack, B. L.

Junior Grade

Culpepper, T. R., Box 13, Uriah, Ala.
Smith, R. F., Box 124, Elba, Ala.

Member Grade

Brasington, J. J., Jr., 3056 Calais St., Mobile, Ala.
Conarro, R. M., Glenn Bldg., Atlanta, Ga.
Fortin, J. B., 527 Sycamore Drive, Decatur, Ga.
Goggans, J. F., Ala. Poly Institute, Auburn, Ala.
Johnson, J. W., Jr., Eglin Air Force Base, Fla.
Mills, W. L., Box 51, Selma, Ala.
Muller, P. M., 725 E. 48th St., Savannah, Ga.
Nance, J. R., 111 S. 9th St., Fernandina, Fla.
Palmer, S. H., Dahlonega, Ga.
Sloss, H. H., 1425 Magnolia Ave., Brunswick, Ga.
Steedley, A. G., Box 86, McRae, Ga.

Affiliate Grade

Griffith, R. L., Box 455, Milledgeville, Ga.
Loper, L. L., Helena, Ala.
McKee, J. R., Box 61, Cantonment, Fla.

Southern California Section

Junior Grade

Pole, R., U.S.F.S., Sierra Madre, Calif.

Southwestern Section

Junior Grade

Blaser, R. A., Box 240, Flagstaff, Ariz.

Affiliate Grade

Moody, H. W., Heber Rgr. Sta., Holbrook, Ariz.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Busch, W. H.
Campen, E. R.
Hanna, S. P.
Haygreen, J. G.
Lokken, C. M.
Morgan, D. J.
Nelson, J. P.
Rymer, K. R.
Smith, J. B.

UNIVERSITY OF MINNESOTA

Beaufait, W. R.
Dykeman, K. K.
Minore, D.
Mirkes, L. H.
Radtke, D. L.

Junior Grade

Fry, H. J., R.R. No. 1, Carlisle, Iowa.
Sorensen, W. M., Box 142, Ames, Iowa.

Washington Section

Junior Grade

Stevens, R. E., 3004 Parkway Terrace Drive, Washington, D. C.

Foreign

Junior Grade

Chapin, W. E., Firestone Plantations Co., Liberia, West Africa.

Alfred B. Hastings (1882-1951)

Alfred Bryant Hastings of Mansfield Center, Conn. died of a heart attack at his home on November 8.

Mr. Hastings was born February 19, 1882 at Claremont, N. H. After receiving the A.B. degree from Dartmouth College in 1904, he taught school before entering the Yale School of Forestry, where he was awarded the M.F. degree in 1911.

Entering the U. S. Forest Service in 1911 in Idaho as forest assistant, he served as administrative assistant and deputy forest supervisor in Montana until 1916, when he resigned from the federal service.

From 1916 to 1919 he was assistant state forester of New Hampshire, and from 1919 to 1925 held the same position in Virginia. Returning to the Forest Service in 1925, he was chief Clarke-McNary Law inspector and senior forester in charge of Clarke-McNary work until his retirement in 1944.

In November 1944 Mr. Hastings was appointed to head up a survey of state forestry administration conducted jointly by the Society of American Foresters and the Charles Lathrop Pack Forestry Foundation, and wrote reports on several states which were published by the Society.

A Member of the Society of American Foresters since 1915, Mr. Hastings served for a number of years on the Committee on State Forestry Organization.

Contents and Title Page Bound in Journal

Table of Contents and Title Page for Volume 49 will be found in the back of this issue. For binding purposes the complete section can be removed by opening the staples.

Forestry News

Conservation Director Dismisses State Forester W. K. Beichler

Without first obtaining the opinion of the forestry committee of the North Carolina Board of Conservation and Development, Board Director George Ross on September 21, 1951 dismissed State Forester William K. Beichler. Mr. Beichler had been continuously employed by the State Division of Forestry and Parks since 1927 in positions as district forester, forest inspector, chief of fire control, and since 1945 as state forester.

Walter J. Damtoft, chairman of the Board's forestry committee, stated that developments "would indicate" that Ross "was motivated by personal animosity toward Beichler." A resolution adopted by the forestry committee without dissent which was likewise accepted by the full Board to be made a matter of record without dissent stated:

"The committee on forestry of the Board of Conservation and Development recognizes that the director, Mr. George Ross, is within his legal rights in dismissing Mr. W. K. Beichler from his position as state forester.

"However, the committee wishes it made a matter of record that this action was taken by Mr. Ross without awaiting an opinion from the committee.

"The committee regrets that this action means the loss to North Carolina of a faithful, intelligent, and honorable public servant with more than 25 years of loyal service to the state."

An editorial in the October 18, 1951 *Asheville Citizen* stated that Mr. Beichler's record in North Carolina was one of "dedicated service and unquestioned competence," and stated further, "*The Citizen* deplores rather than regrets the obvious conclusion that the State's great natural resource is to be governed by political whim."

Pending the selection of a new state forester, Mr. Ross plans to clear forestry matters through his administrative assistant, Frederick H. Claridge, who until a few months ago was assistant state forester in charge of forest management. Philip H. Griffiths currently occupies that position.

Mr. Beichler is a 1925 forestry graduate of Pennsylvania State College. He worked for the U. S. Forest Service in North Carolina for two years before being employed by the state.

Wilm Named Chief Forest Influences Division

Harold G. Wilm, in charge of flood control surveys at the Pacific Northwest Forest Experiment Station in Portland, Ore. has been appointed chief of the Division of Forest Influences in the Washington office of the Forest Service. He succeeds Edward N. Munns, who retired August 31.

Wilm, in his new assignment, will coordinate research activities in watershed management, flood control, and the relation of climate, soil, and water to forests.

Wilm was first employed by the Forest Service at the Cass Lake Branch of the Lake States Forest Experiment Station in Minnesota in 1932. At the end of the same year he was transferred to the California Forest and Range Experiment Station where he helped install rain measurement systems for the San Dimas Experimental Forest, and in 1935 headed-up all watershed management studies there.

In 1938 he took charge of the forest influences division of the Rocky Mountain Forest and Range Experiment Station. Ten years later he went to the Southern Forest Experiment Station at New Orleans to take charge of flood control survey and flood control projects. In October 1949 he took over his present position.

Wilm invented the San Dimas Flume to measure the flow of mountain streams which have accumulated debris, a portable millemeter water-depth measuring gage, and a device to determine moisture infiltration.

Wilm is a native of Topeka, Kan. He received his B.S. degree in forestry from Colorado College and his M.F. and Ph.D. degrees from Cornell University. He is associate editor, for forest influences and soils, of the JOURNAL OF FORESTRY.

Southern Agricultural Workers to Meet in February

The 49th annual meeting of the Association of Southern Agricultural Workers will be held in Atlanta, Ga., February 4, 5, and 6, 1952. The Atlanta Biltmore Hotel will be convention headquarters, with most of the sessions being held there. Theme of the meeting will be "Our Opportunity in World Agriculture."

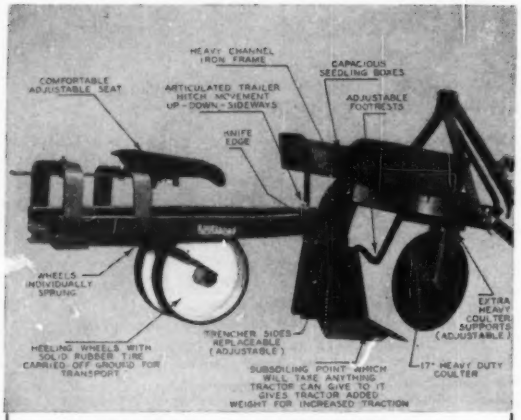
Wirth to Become National Parks Director

A federal government career extending over 48½ years will end with the close of business on December 8, when the retirement of Arthur E. Demaray, director of the National Park Service since April 1, 1951, becomes effective.

Conrad L. Wirth, who succeeds Mr. Demaray as director, has been with the National Park Service in various capacities since 1931, except for a year, in 1945-46, when he was loaned by the Department of the Interior to the United States Allied Council in Austria. He was born in 1899 in Hartford, Conn., where his father was superintendent of parks, before becoming, for 28 years, superintendent of Minneapolis parks; his brother Walter, now in charge of Pennsylvania state parks, was for many years superintendent of parks in New Haven, Conn.

A graduate of Massachusetts State College, now the University of Massachusetts, in landscape architecture, Mr. Wirth entered the federal service in 1938, with the National Capital Park and Planning Commission, after five years of private practice in San Francisco and New Orleans. While assistant director in charge of the National Park Service's branch of lands, in 1933, he was assigned direction of Emergency Conservation Work on state parks; three years later he was placed in charge of the entire ECW program of the Park Service. He also directed the park, parkway, and recreational area survey authorized by Congress in 1936. After his return from Austria, he resumed direction of the land planning functions of the Service until his appointment as assistant director in 1949.

The retiring director began his federal service as a messenger boy with the Geological Survey in 1903. Before transferring to the newly established National Park Service in the spring of 1917, he was employed as an apprentice draftsman with the Bureau of Reclamation in Nevada; as a civilian draftsman with the War Department in Cuba with the Second Army of Pacification; and as a topographic draftsman with the Geological Survey. Starting with the Park Service as a topographic draftsman, he has been successively editor, administrative officer, senior administrative officer, executive officer, associate director, and director.


HEAVY CHANNEL IRON FRAME
COMFORTABLE ADJUSTABLE SEAT
ARTICULATED TRAILER HITCH MOVEMENT UP-DOWN-SIDEWAYS
CAPACIOUS SEEDLING BOXES
ADJUSTABLE FOOTRESTS
KNIFE EDGE
WHEELS INDIVIDUALLY SPRUNG
EXTRA HEAVY COULTER SUPPORTS (ADJUSTABLE)
TRENCHER SIDES REPLACEABLE (ADJUSTABLE)
HEELING WHEELS WITH SOLID RUBBER TIRE CARRIED OFF GROUND FOR TRANSPORT
SUBSOILING POINT WHICH WILL TAKE ANYTHING TRACTOR CAN GIVE TO IT GIVES TRACTOR ADDED WEIGHT FOR INCREASED TRACTION
17" HEAVY DUTY COULTER

ROOTSPRED TREE PLANTER

1. Adapted to all tractors with 3-point lift: (Ford, Ferguson).
2. Will plant on curves, on the contour and on steep slopes.
3. Safe—can't upset unless the tractor does.
4. Subsoiler point loosens and lifts soil. Allows better root spread and better packing.
5. Easily transportable—raise with power lift and drive away.
6. Heeling wheels on individual springs for better heeling.
7. Husky, not a light planter.

For further information and close-up photos write

ROOTSPRED
318 N. Market St., Fredrick,, Md.

PLANTING BARS
COUNCIL'S
OST PATTERN

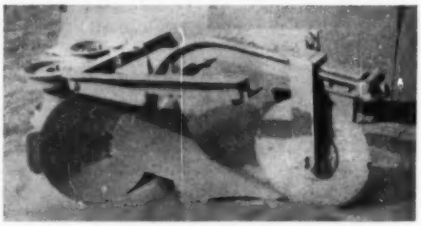
FIRE RAKES
and SWATTERS

BRUSH HOOKS,
BANK BLADES,
THINNING AXES,

POISONING AXES

THE
COUNCIL TOOL CO.
MAKERS

WANANISH, N. C.



STOP THAT FIRE
RANGER PAL JR. FIRE PLOW

The Ranger Pal Junior fire plow is a hand or hydraulic lift middle-buster with coulter and discs. Drawbar connection built of 1" cast steel T-beam. Has 16" coulter roller bearing assembly with grease seal, mounted ahead of 14" tempered steel middle-ouster, capable of cutting large underground roots. One 16" harrow disc bearing assembly is mounted on each side and slightly behind the middle-buster wing which turns the sod over and out. Depth of plowed line may be adjusted by either the presence or absence of two spool weights attached on rear of plow. Leaves a 5 foot earth line and can be drawn by any piece of light equipment, Ford type tractor, jeep or power wagon. Built compact and sturdy for ease in handling and reduced maintenance costs. Tested and proven by Louisiana Forestry Commission. Made by makers of Ranger Pal Fire Plow. Not designed to supersede the Ranger Pal but adapted for lighter equipment. Mass production price at $385.00 each, f.o.b. shop. Workmanship guaranteed.

Ranger Pal Fire Plow production price at $495.00 each f.o.b. shop. Write for further details on both plows.

TWIN CITY WELDING & MACHINE SHOP
301 Jonesboro Highway
WEST MONROE LOUISIANA

SOUTHERN GLO
TIMBER MARKING PAINT
White—Yellow—Red—Blue

Still available for immediate shipment, both paste and ready mixed. Write for prices and literature. Order direct from factory.

SOUTHERN COATINGS AND CHEMICAL COMPANY
SUMTER, SOUTH CAROLINA

TOOTS-E
WHISTLE

No logging operation is complete without a Toots-E Signal System. The long sound range, plus trouble free operation puts Toots-E on top of the industry. Write today Dept. J-1 for catalog.

C. M. LOVSTED & CO., INC.
4000 West Marginal Way, Seattle 6, Wash.

Offices and warehouses in San Francisco, Los Angeles, Vancouver, B.C., Honolulu, Manila, R.P.

New Forest Products Journal

The Forest Products Research Society announces the release of the first issue (September 1951) of its new publication, *Journal of the Forest Products Research Society*. It contains 44 semi-technical papers which have been presented at 11 section meetings of the society over the past year. The majority of these papers have not been published previously by the press or by the society and are thus being made available for the first time in the new *Journal*. The volume is green paper-bound and runs 176 pages.

A partial list of contents includes papers on the following general subjects: adhesives, sawmilling, quality control, chemical utilization, board manufacture, naval stores, woodworking machinery, waste utilization, seasoning and preservation, logging, furniture and veneer, and plywood.

The papers are illustrated with photographs, tables, charts, and other line drawings. Also contained in this issue are 4 pages of abstracts of technical articles.

Copies of the new *Journal* are now being sent to all members of the society as a part of their membership. Copies are also available to nonmembers at a cost of $2.50 each. Orders can be sent to the Office of the Executive Secretary, Forest Products Research Society, Box 2010, University Station, Madison 5, Wis.

Stump Named to Extension Post

William G. Stump was appointed assistant extension forester at Michigan State College effective September 1. He will be responsible for forestry extension activities in the southwestern section of the lower peninsula and will serve as wood utilization specialist for the extension forestry staff.

Mr. Stump received his B.S. in forestry from Iowa State College in 1937. Just before graduation and shortly after he did part time work in forestry extension. From 1938 to 1941 he taught in the Industrial Arts Department of the Omaha Technical High School. For about six months in 1941 and 1942 he worked in the Flood Control Section of the U. S. Army Engineers. Following his flood control work he was with the Patten Logging Company, Amasa, Mich. for a short time, buying and inspecting pulpwood. Late in 1942 he became a farm forester in northeastern Iowa, continuing this work until the spring of 1946. Since then he has been forester for the Northern Casket Company, Fond du-Lac, Wis.

Canadian Institute of Forestry Meets at Banff

The annual meeting of the Canadian Institute of Forestry (formerly the Canadian Society of Forest Engineers) was held at Banff, Alberta, during the period October 11-13.

K. G. Fensom of Vancouver, B. C. succeeded R. E. Balch of Fredericton, N. B. as president for the next two years. In assuming the presidency Mr. Fensom retired as editor of the *Forestry Chronicle*, an office he has held for the past seven years.

W. A. E. Pepler of Montreal is the newly elected vice chairman. D. V. Love of Toronto continues as secretary-treasurer.

Mr. Pepler has been named as general chairman for the joint meeting of the Canadian Institute of Forestry and the Society of American Foresters to be held in Montreal next November. J. L. Van Camp of Montreal, manager of the Canadian Forestry Association, has been appointed chairman of the Program Committee.

At the annual dinner of the C.I.F. held on October 13, a presentation was made of a special conservation award on behalf of the Canadian Forestry Association to Ellwood Wilson of Knowlton, Quebec. Mr. Wilson is a Fellow of the Society of American Foresters.

At Banff the Society was represented by Henry Clepper who conferred with the C.I.F. board of directors about plans for the joint meeting of the two organizations.

Strip-mined Land Will Grow Trees and Grass

Most of the 65,000 acres of strip-mined land of Missouri, Kansas, Oklahoma, Arkansas, and Iowa can be used for forests, pastures, orchards, or recreation, according to Nelson F. Rogers, research forester at the Northern Ozark Branch of the Central States Forest Experiment Station, Columbia, Missouri.

This area and its possible uses are described by Rogers in a publication, "Strip-Mined Lands of the Western Interior Coal Province," recently published by the University of Missouri Agricultural Experiment Station. This report is a result of a survey made in 1946 by the Central States Forest Experiment Station to find out the location, area, and condition of strip-mined land in the province.

Merry Christmas
for the whole family
THE WORLD'S
FINEST BINOCULAR
There's a lifetime of pleasure ahead for the owner of a Bausch & Lomb Binocular. Every member of the family, too, will enjoy the clear close-up seeing, at sports events, for travel, nature study, hunting, boating. Write for our informative 32-page catalog. It tells how to select a binocular, and why the quality of Bausch & Lomb-made instruments is important to clear seeing and long service. Bausch & Lomb Optical Co., 611 Lomb Park, Rochester 2, N. Y.
Bausch & Lomb
Zephyr-Light
7X, 35mm Binocular
Balcoted Optics
$135, plus tax
BAUSCH & LOMB
Binoculars

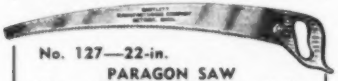
Preserve Those Age-Old Trees with Bartlett TREE Tools and Supplies

No. 1-W
TREE TRIMMER
Long pole. Rope Pull Type. Sectional poles 4 to 16 ft. Powerful Compound Lever Head cuts 1¼-in. branch easily. Lightweight.

No. 44
POLE SAW
16-in. blade. Any length pole.

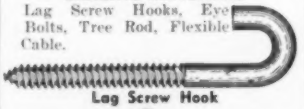
No. 1-W No. 44

GOOD PRUNING
means better trees and better foliage. It is easy to do good work with the BARTLETT PRUNERS.



No. 127—22-in.
PARAGON SAW
Many types of Saws, especially designed for tree-trimming work.

BRACING MATERIALS
Lag Screw Hooks, Eye Bolts, Tree Rod, Flexible Cable.



Lag Screw Hook

New No. 999 Improved Hand Pruner

BARTLETT TREE PAINT
Protects pruning wounds. Easily applied. Will not freeze.

No. 777—
LOPPING SHEAR
26" White Ash Handles with Plain or Strap Ferrules. This shear is unsurpassed for cutting qualities. Tool Steel Blades.

Write for free illustrated catalog.

BARTLETT MANUFACTURING CO.
3015 E. Grand Blvd., Detroit, Mich.

Advises on Land Management Problems in Paraguay

Luther T. Hoffman, Bureau of Land Management administrator for the California-Nevada region has been named advisor to the Joint Commission for Economic Development on land management problems under the Point Four Program.

The Joint Commission, a continuing body of Paraguayan and United States experts, makes studies and recommendations to the two governments on Paraguay's technical cooperation needs to assist the country in improving economic and social conditions.

During his three months assignment, Mr. Hoffman will help the commission determine what types of technical cooperation Paraguay needs in the land management field to extend its program for the settlement of large areas of undeveloped public lands and the fuller use of natural resources. He will advise on the need for good public land laws, secure land titles, cadastral surveys to identify boundaries, and land classification to direct people to better lands.

In addition, he will give advice on the management of organized grazing districts and timber areas, and other resource development.

Through extension of a resettlement program, Paraguay hopes to increase agricultural, livestock, and timber production upon which the country's economy is mainly based.

Weather Improvement Meeting

The annual meeting of the National Weather Improvement Association will be held in the Cosmopolitan Hotel, Denver, Colo., January 10 and 11, 1952.

The two-day program will include papers by leading scientists in the weather improvement field, and will consider reports and studies of recent cloud seeding work. For details and reservations write to the National Weather Improvement Association, 202 Elizabeth St., Fort Collins, Colo.

National Forest Receipts Show Increase

Receipts from national forests during July and August increased more than 43 percent over those for the corresponding period a year ago.

During the first two months of fiscal year 1952 (July and August) the Forest Service collected $13,941,122 from the sale of timber, grazing fees, land use permits, and water power rights. For the same period last year the forests collected a total of $9,707,813.

Kentucky Management School

An annual forest management school, sponsored by the Kentucky division of forestry, was completed this fall at Kentucky Ridge Forest near Pineville. Harry Nadler, assistant director of the Division of Forestry, was in charge of the five-day school. Thirty representatives from the U. S. Forest Service, Soil Conservation Service, Tennessee Valley Authority, Kentucky Division of Soil and Water Resources, private wood using industries, and foresters and specialized personnel from the Division of Forestry, attended the school.

Courses were given in timber estimating and silviculture, log grading, log scaling, pine plantation thinnings, examination and study of recently cut timberland sale areas, natural reproduction of yellow poplar, timber stand improvement, and the use of Ammate in timber stand improvement.

Water Proof Fiber Board

New full-wall panels which are thoroughly waterproofed throughout every fiber as well as on the surface have been developed by the Upson Company of Lockport, N. Y.

Tests conducted by the Pittsburgh Testing Laboratory proved the new waterproofed panels do not absorb more than 13.5 percent by weight when entirely submerged in water for 24 hours.

Dr. Walter Paul Ericks, director of research, who developed the waterproofed panels over a five-year period has had a 7 by 9 inch sample of the waterproofed panel in a pan of water since March 20, 1950. It has been floating ever since and shows no signs of delamination.

Mando Graduate Research Fellowship

Roland E. Schoenike, a 1951 graduate of the University of Minnesota School of Forestry, has been awarded the Minnesota and Ontario Paper Company Graduate Research Fellowship in Forestry for 1951-52.

Established in 1946, the Mando Fellowship provides for studies concentrated on forestry problems meriting special attention. This year's fellowship, said Dr. Frank Kaufert, director of the School of Forestry, will be used to continue the previously initiated study of reproduction on recently cutover state and private lands and to begin an investigation of the regeneration status of uncut black spruce swamps.

Massachusetts Acquires Gift: Cadwell Memorial Forest

A gift of 1,200 acres of land to the University of Massachusetts has been made by Mrs. Esther Hyde Cadwell of Akron, Ohio.

The university's new tract includes Mt. Lincoln and comprises almost two square miles of forest preserve in the town of Pelham. It will be called the Cadwell Memorial Forestry Reservation in memory of the donor's husband, Frank A. Cadwell who died in 1935.

A native of Pelham, Mr. Cadwell had operated a large lumber business in Hampshire County prior to 1929 when he became president of the Amherst Savings Bank, a post he held until his death.

Robert P. Holdsworth, head of forestry at the state university, said the new reservation offers excellent laboratory facilities for practical studies in silviculture, forest mensuration, and type-mapping.

The new reservation is located about seven miles from the state university campus in Amherst. It is easily accessible. A state fire warden's tower is located within its borders.

Radio System Speeds Association's Logging

Representatives of twenty firms in the logging and lumbering business have set up a jointly owned F.M. 2-way radio network with all-Motorola equipment.

The companies, all members of the Southern Oregon Conservation and Tree Farm Association, have a system made up of 41 radio equipped cars and trucks and 5 portable stations. The network blankets approximately 90 percent of Jackson County.

The nucleus of this forest products radio communications network is a remotely controlled relay repeater station located on Roxy Ann Mountain, 4.5 miles from the Goldy building in Medford in which is located the central control unit in the offices of the Southern Oregon Conservation and Tree Farm Association.

Conference on Charcoal

At the conference on charcoal production and uses, held by the Northeastern Wood Utilization Council at the University of New Hampshire on September 14, charcoal men from various sections of the country reported that the supply is dangerously short. The wood distillation plants, which formerly produced charcoal as a by-product, have been going out of business, as they cannot compete with the chemicals made from coal or petroleum. At the same time the demand for charcoal has been increasing, both industrial as a result of the war effort, and domestic, with the growing use of outdoor grills. Papers were given at the conference on new methods of charcoal production. These range from the continuous yield retorts recently developed in Europe, to portable kilns of various types for domestic production. The papers and discussion will be published about January 1 by the Northeastern Wood Utilization Council at its office in New Haven, Conn.

SEEDS FOR NURSERYMEN

TREE — SHRUB — PERENNIAL — FLOWER — VEGETABLE

Correspondence with Seed Collectors Invited

HERBST BROTHERS

Established 1876

92 WARREN STREET NEW YORK 7, N. Y.

Mack

POLE TYPE

LOGGING DOLLIES

For heavy duty. Also furnished with tandem axles. Welded steel construction.

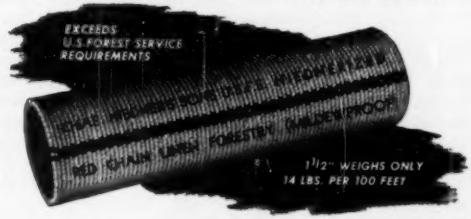
Ask about Mack Grapples and Mack Log and Pole Tongs, for safe handling of all timber products.

MACK WELDING COMPANY

Manufacturers

9204 GRAND AVE. PLACE DULUTH, 8, MINNESOTA

It Won't Mildew!



RED CHAIN

PURE LINEN

FORESTRY HOSE

Red Chain Pure Linen Forestry Hose is the lightweight hose to meet severe forest service requirements. Mildew-proofed by our exclusive Niednerizing process for more efficient, longer life. Strong, lightweight, flexible, compact. Sizes 1, 1½ inch, lengths, 50, 100 feet. Look for the distinctive Red Chain stripe. Send your order to nearest address below for immediate delivery.

Ask also about Rendein Pure Linen Fire Hose for indoor protection.

CHAS. NIEDNER'S SONS COMPANY

MALDEN 48, MASS.

Stocked For Immediate Delivery By . . .

WESTERN FIRE EQUIPMENT CO.
69 Main Street, San Francisco 5, Cal.
Tel.: Sutter 1-0618

RALSTON R. CUNNINGHAM CO., INC.
73 Columbia Street, Seattle 4, Wash.
Tel.: Main 2341

BELSAW ... Over 30 Years in the Development and Manufacture of PORTABLE SAWMILL EQUIPMENT

Thousands of Belsaw Portable Sawmill users throughout the world . . . Belsaw goes right to the trees, thus getting more lumber from all the cut timber. For low cost, high quality production the Belsaw line leads the field. Write today for Free Book, "How To Make Lumber."

BELSAW MACHINERY CO
8911 Field Building, Kansas City 2, Missouri

Rich Forest Fire Fighting Tool
Geneva Rich Bickel WOOLRICH, PA.
Write for Prices and Descriptions

DON'T BREAK YOUR NECK! PREVENT ACCIDENTS!
CUT LABOR COSTS 'n SO2 DOUBLE PRODUCTION! With the New, Amazing, LIGHTWEIGHT ALUMINUM Comb. Sawing, Pruning, Trimming, Fruit Picking, Shaking Poles.

Curved Type Tree Saw No. 1
AVOCADO PEAR PEACH & APPLE PICKER No. 12
Fruit Picker No. 6
Hook No. 5
Block & Tackle Trimmer No. 7
Tree Saw No. 9
SECTIONAL POLES 1/3 WT. OF WOODEN POLES

Combine Sections of Poles to make Poles up to 60 ft. tall. Weighs 1 lb. per 5 ft. 70c per ft. Attachments extra. F.O.B. Los Angeles. No Breakage. No Splinters. Lasts Forever. Sections from 2 to 30 ft. Reaches top of any tree. A 60 ft. pole weighs only 12 pounds. SEND FOR FREE CATALOG & FREE BOOKLET

HOW TO PRUNE FRUIT & SHADE TREES

TELLS YOU HOW TO INCREASE THE QUALITY and QUANTITY of Your FRUIT as Well as the BEAUTY OF YOUR TREES.

J. D. Sebrell CORP
300-S. Los Angeles St.
Los Angeles 13, Calif. - MA. 6-9397

FILSON
BETTER OUTDOOR CLOTHES FOR MEN OF THE **FOREST SERVICE**

SINCE 1897 — FILSON BETTER OUTDOOR CLOTHES — MAIL ORDERS FILLED POSTPAID

FREE ILLUSTRATED COLOR BOOKLET SENT ON REQUEST

Weatherman's OUTDOOR WEAR
1300 First Avenue Seattle, Wash.

TREE GROWERS are getting their conservation information in a new capsule introduced by the Southern Pulpwood Conservation Association. A trailer housing two large and one small diorama displays and a decorative flow chart showing the conversion of trees to paper, with illustrations of major paper uses, has been planned and built over a period of two years at a cost of approximately $10,000.

Design and construction of the dioramas was handled by H. B. Wright, curator of the Louisiana State Museum.

Save-The-Redwoods League Elects New Officers

Arthur E. Connick was elected president of the Save-the-Redwoods League at the annual meeting of the council of the league, held October 17, in San Francisco. Mr. Connick, a pioneer in the Save-the-Redwoods movement and one of the original incorporators of the league in 1920, has been a director of the conservation organization since 1938, and vice-president since 1944, as well as chairman of the league's redwood land purchase negotiating committee for many years. He is chairman of the board of the Pacific National Fire Insurance Company, San Francisco and a resident of Berkeley, Calif. As president of the Save-the-Redwoods League he succeeds the late Duncan McDuffie, noted conservationist and civic leader.

Elected to the board of directors of the league besides President Connick are Dr. Ralph W. Chaney, William E. Colby, Norman B. Livermore, J. W. Mailliard, Jr., Walter A. Starr, and Frank W. Wentworth. New members elected to serve on the council of the league are Mrs. Duncan McDuffie, of San Francisco; John Jewett Garland, of Los Angeles; George Waldner, of Ferndale, Calif.; George W. Merck, of New York; and Prof. Howard McMinn, of Mills College, Oakland.

The membership of the league is now 16,000, it was reported at the meeting, but it was emphasized that additional members are desired to help carry out the league's program of forest preservation, including the Avenue of the Giants and the South Calaveras Grove acquisition programs.

Contributions are sent to the league's treasurer, Dr. Robert Gordon Sproul, 250 Administration Building, University of California, Berkeley 4.

International Mill Host to Woodlands Personnel

Over 120 key personnel of the Woodlands Department of the Southern Kraft Division of the International Paper Company held an annual conference at the Villa Ambrose, Myrtle Beach, S. C., October 2-5. Personnel attending came from the Carolinas to Texas. J. E. McCaffrey, division superintendent of the Georgetown mill and his personnel were host to the visitors. The meeting consisted of two field trips and two indoors sessions.

The meetings are held annually to coordinate activities and to bring about the exchange of ideas between International Paper Company's nine southern mills. The field trips stressed pulpwood truck mechanization, barge operations, mechanization, and silvicultural practices followed by the Georgetown mill. The indoors sessions discussed primarily mechanized rail woodyards, public relations, stumpage prices, and the coordination which is necessary between timberlands and woodlands.

Dean Illick Honored By Boy Scouts

Dean Joseph S. Illick of State University College of Forestry, Syracuse, N. Y. is one of seven New York and New Jersey men who have been honored by the Boy Scouts of America with the Award of the Silver Antelope. The recognition was tendered at a special luncheon October 20 in Buffalo.

Dr. Illick received the Silver Beaver award from the Boy Scouts in 1950. He has been an advisor and a councilor of Onondaga Council, Boy Scouts of America, since joining the faculty of the forestry college more than 20 years ago.

The Silver Antelope citation to Dr. Illick referred to him as "teacher, conservationist, author" and credits him as having "contributed to many phases of American life, particularly in the field of conservation."

The citation continues, "His lifelong work has been in forestry education, but his great interest has been in the development of young men. He directed surveys and reforestation projects with Scouts and Scouters at council camps and has helped other camps in the development of their conservation projects."

New Consulting Firm

Another firm of consulting foresters was established recently to meet the growing demand in the South for more foresters in the woods. James M. Vardaman announced the opening of the office of James M. Vardaman & Company, Forest Consultants, at 204 Seventh Street, Laurel, Miss. The new firm specializes in timber estimating and handling sales of all types of timber products.

James M. Vardaman is a 1942 forestry graduate of the University of Michigan. After three years in the Army and two years as forester for the Hobae Veneer & Lumber Company, Caruthersville, Mo., he came to Laurel in 1948 and since then had been district forester in charge of 18,000 acres for the Masonite Corporation.

Aerial Surveys Booklet

A new illustrated booklet, *Aerial Surveys and Maps from Photographs*, is now available from Abrams Aerial Survey Corporation, Lansing 1, Mich. It presents briefly a nontechnical explanation of aerial photogrammetry, including the use of infra-red photography. Copies are available from the corporation.

30% more efficiency

—with RCA 2-WAY RADIO

The AC Portable Carfone (152-174 Mc)—a single-unit radio complete with transmitter, receiver, power supply, portable antenna, mike, and speaker.

James Camillone, owner-operator of Vet's Cab Company talks to dispatcher 10 miles away—instantaneously!

An alert businessman in Conneaut, Ohio, looked for a quick way to boost his net—and found it! Now, with RCA radio, two cars do the work of three. Close control of rolling cars speeds responses—gets car to next point faster—cuts "empty returns." All this, plus a tidy savings on gas, oil and general wear and tear. Here's how it's done.

On his dispatcher's desk, James Camillone set up an AC Portable Carfone—a complete 2-way FM radio like the unit shown above. Then in each car he installed a mobile 2-way Carfone. A simple system. *Yet it provides reliable communication over a 500-square-mile area, 24 hours a day!*

Just one example of how this portable RCA 2-way radio is paying off in transportation, industrial and safety operations. A Pacific coast company uses it to co-ordinate ship unloading. A city in California uses it to control its police and fire-fighting vehicles. A coastal patrol service uses it as a relay in its communication system. It's a natural for co-ordinating survey and construction activities and for rapid shifting of men and equipment from one job to another.

For an analysis on the use of 2-way radio in your operations, write Dept. S-151, RCA Engineering Products, Camden, N. J. (*In Canada, write RCA Victor Company Limited, Montreal.*)

Dept. 126 X
RCA Engineering Products
Camden, N. J.

FREE—*new book on the RCA AC Portable Carfone.*

Send me the new illustrated book about the RCA AC Portable Carfone that operates wherever there's an AC outlet.

Name_____

Company_____

Address_____

City_____ State_____

RCA **RADIO CORPORATION of AMERICA**

Unicel Refrigerator Truck-Trailer

A new and revolutionary refrigerator truck-trailer made of cellular plastic-laminated plywood and called the Unicel was introduced to top trucking, shipping, and government executives in Chicago October 22. The new vehicle, first non-metal truck-trailer to be built with the strength of steel, was designed and built by the Pressed Steel Car Company, Inc., of Chicago, to specifications furnished by the Brown Equipment & Manufacturing Company.

The plastic-faced plywood construction saves war-scarce metals—the aluminum, stainless steel, and carbon steel of which conventional trailers are generally built.

The new trailer is constructed of cellular laminates, made by laminating strong plywoods grain-against-grain with specially formulated super-strength plastics. The laminate sections are then subjected to high-frequency heat applied under tremendous electronic pressures molding the sections to form a single unit-cellular structure (from which the finished structure derives its name, Unicel). The only steel used in the construction of the trailer is in its heavy duty tandem and kingpin wearplate assembly and the doorframes. A company spokesman estimated that 200 tons of metal could be saved on an order for 100 Unicel trailers compared to an order for 100 conventional metal trailers.

Bark Beetle Damage to Southern Pine

Widespread killing of pine trees by bark beetles continued in 1951 in the South according to entomologists of the U. S. Department of Agriculture. They estimate that more than 50 million board feet were ruined in the summer months. The southern pine beetle, as in 1950, caused greatest damage. However, it was aided in its destructive activities by the black turpentine beetle and species of pine engraver beetles.

The southern pine beetle was especially troublesome in portions of east Texas and eastern North Carolina. The black turpentine beetle caused damage in North Carolina, Florida, Mississippi, and Louisiana. Large numbers of trees faced for turpentining in North Carolina and Florida were killed by the turpentine beetle. The pine engraver beetles killed pines throughout the South. Losses from the southern pine beetle and the engraver beetles were less than they might have been however because timber owners promptly salvaged as lumber a large portion of the attacked trees.

There was evidence early this fall that outbreaks of the southern pine beetle were subsiding. This offers hope, says the entomologists, that damage by this beetle might be less next year.

Packaging Materials Sample Kit

A sample kit of packaging and cushioning materials, meeting government specifications, is now offered by the Wood Conversion Company of St. Paul, Minn., manufacturers of Tufflex Cargo-Pak.

The kit contains samples of the three basic types of Cargo-Pak, absorbent, partially absorbent, and non-absorbent. Type I—non-water resistant or absorbent Cargo-Pak is capable of taking up more than sixteen times its own weight in water. Type II—water resistant or partially absorbent Cargo-Pak is used for general cushioning because of its high wet strength. Type III—non-absorbent or water resistant Cargo-Pak.

INCREMENT HAMMERS

MADE IN
MORA, SWEDEN

- Accurate
- Fast
- Sturdy
- Weighs 13 oz.
- 10" long

Designed for quick, easy examination of bark and recent tree growth. Use like a hammer and extract ¼" core *instantly*. A time-saver in selective cutting operations. Your free copy of our Forester's Tool Catalog is yours for the asking.
Write Dept. J.

$12.85 EACH POSTPAID—SORRY! NO C.O.D.'s

SANDVIK SAW & TOOL
DIVISION OF SANDVIK STEEL, INC.
47 WARREN STREET NEW YORK 7, N. Y.

WEAR THE EMBLEM THAT YOU PREFER

Available in 3 styles for all grades of membership

PIN 5/8" wide, 10K solid gold border and letters in glossy green background $4.00

TIE CHAIN & PENDANT, adjustable to tie of any width, pendant similar to pin $6.00

BUTTON for lapel, 3/8" wide, perfect miniature of pin but with screw back $2.50

Quoted prices include 20 percent federal tax

Send order to

SOCIETY OF AMERICAN FORESTERS
825 Mills Building
Washington 6, D. C.

Range Rehabilitation Pamphlet

Rebuilding the Federal Range is a new Bureau of Land Management publication dealing with the "great potentialities and needs of BLM's resource conservation and development program on public range lands." It is essentially a policy statement on the objectives and techniques of Bureau of Land Management administration of public lands.

"Through the publication of *Rebuilding the Federal Range*," explains Director Marion Clawson, "we are submitting for discussion and study a most comprehensive report on the aims, methods, and administration of the Bureau of Land Management of 171 million acres of publicly owned range . . . an area of incalculable value in the stabilization of the American livestock industry, preservation of the watersheds on the great river systems of the West, and the multiple-purpose use of lands of great importance to the economy and security of the Nation."

Twenty-four pages, with photographs, drawings, graphs, and maps, the new pamphlet is sold by the U. S. Government Printing Office for 35 cents. Individuals concerned with public land management and use of the federal range may obtain without cost copies from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Louisiana Becomes Thirtieth Tree Farm State

Louisiana became the South's eleventh and the Nation's thirtieth Tree Farm state when five properties totalling 122,835 acres were certified on October 24.

Certificates were presented to Louisiana's first Tree Farmers by Col. William B. Greeley, chairman of the board of American Forest Products Industries. In Louisiana the Tree Farm program is sponsored by the Louisiana Forestry Association, with the cooperation of the Southern Pine Association.

"Looking back over 40 years of Southern forestry," said Colonel Greeley, "this dedication of the first Tree Farm in Louisiana to me is a memorial to a very great man. Henry E. Hardtner, founder of the Urania Lumber Company, Ltd., was the father of southern pine forestry."

"There is nothing in the history of forestry so impressive as the recovery of the southern pineries and their industrial progress during the past 30 years," Colonel Greeley declared. "Both the prophets and many hard-headed business men wrote southern pine off when the last virgin timber was on its way to the sawmills. But the little pines have had the last word."

Charles H. Jeter, president of the Louisiana Forestry Association, welcomed the crowd of more than 400 present for the ceremonies. Other speakers included Lloyd P. Blackwell, chairman of the Tree Farms committee; James E. Mixon, state forester; Q. T. Hardtner, president of the Urania Lumber Company; and H. C. Berckes, secretary-manager of the Southern Pine Association.

Mr. Berckes pointed out that more than half the nation's tree farmers live in the South and that, together, they own well over 14,000,000 acres of certified timberland.

Four small woodlots along with a 122,700-acre industrial forest, owned by the Urania Lumber Company, Ltd. were certified during the ceremonies.

Robert W. McDermid Appointed, Louisiana State University

Robert W. McDermid was appointed associate professor of forestry, Louisiana State University, effective September 16, 1951. He takes the place of William McD. Palmer who resigned to return to work with the State Forestry Commission of Louisiana.

McDermid is a native of South Carolina. He received a B.S. degree at Davidson College, Davidson, N. C. in 1930.

After receiving his M.F. degree from the Yale School of Forestry in 1937 he spent six and one half years as a forester for the Crossett Lumber Company of Crossett, Ark. From 1943 to 1945 he was employed by the Timber Production War Project in Alabama and Texas. Since 1945 he has been with the Champion Paper and Fibre Company at Houston, Tex. as division forester.

Stop Woods Fires

Twenty-five thousand automobiles and trucks in the eleven southern states are displaying a forest fire prevention message. Bumper strips with the slogan "Stop Woods Fires" have been released by the Southern Pulpwood Conservation Association, Atlanta, Ga.

Forestry graduate, B.S.F., 27 years old, married, no children, desires position, preferably in park work, research, city park or forestry department. Experience with U.S.N.P.S. and U.S.F.S. Several U.S. Civil Service grades. Member S.A.F. Excellent for public contact. References and detailed information on request.

Box O, Journal of Forestry, Mills Building, Washington 6, D. C.

Positions Available

Wanted technical foresters between the ages of 21 and 32 to fill positions as county foresters in a southern state. Duties include fire control, management, reforestation, and public relations. Excellent advancement opportunities in an expanding organization. Immediate placement.

Box L, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester with experience in cruising hardwoods along the Gulf Coast. Excellent future for right man. Write giving detailed information and references; also salary expected.

Box 765, Albany, Georgia.

Positions Wanted

Graduate forester with broad experience desires position in the Northeast. Experience includes 8 years with the U. S. Forest Service, 7 years with the Soil Conservation Service, and 2 years with private industry. Now employed as an industrial forester in the South. Age 39, married, two children.

Box F, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, twenty years' experience in private and public forestry, desires to locate in South Atlantic or Gulf states with progressive forest industry. Especially familiar with the production and procurement of poles, piling and cross-ties, and the management of slash and longleaf pine. References and detailed information on request.

Box G, Journal of Forestry, Mills Building, 17th St. at Pennsylvania Ave. N. W., Washington 6, D. C.

Forester, B.S.F. 1950 graduate, 30 years old, single, desires position with company located in the eastern part of the country. Experienced in surveying, timber cruising, and chemical spraying. References and details upon request.

Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

B.S.F. 3½ years of well-rounded experience in forest management and fire control as public service forester. Desires opportunity to put forestry into practice on lands of interested company, with chance to learn other aspects of private forestry. Chances for advancement and future outlook are main objectives; salary is important (have family of three) but secondary.

Box K, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 38 now employed in private industry; a logging and woods products operation. Six years with present concern. Desire to relocate for better opportunity. Prefer private industry. Experience includes logging, aerial photographic mapping, administration of logging contracts, reforestation, stand improvement work, growth studies, surveying, personnel labor relations, timber appraisal, insect, disease and fire control work. References and details upon request.

Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

Forestry graduate, B.S.F., in general forestry, M.F. with major in wood utilization, 4 years experience administering timberlands. World War II veteran, age 33, married with two children. Desire position in research in wood utilization but qualified for work in timberland management. References and detailed information upon request.

Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

FIFTY YEARS OF FORESTRY IN THE U. S. A.

New — Interesting — Historical

Just Published **$4 Postpaid**

The dynamic growth of forestry in the 20th century recounted by 19 eminent foresters. A factual text and reference book. Order today.

Society of American Foresters
Mills Building, Washington 6, D. C.

Aerial Spraying for Brush Control in Minnesota

Brush killing chemicals were sprayed from airplanes on two areas in northern Minnesota in tests undertaken jointly by the Lake States Forest Experiment Station and the School of Forestry of the University of Minnesota. The Minnesota Forest Service, the Northwest Paper Company, and the Minnesota and Ontario Paper Company collaborated. The Garrett Flying Service, the Northeast Airways, and the Triangle Aviation Service assisted in the planning and did the spraying, and the Dow Chemical Company furnished the chemicals used.

One of the areas was covered with a great variety of lowland brush species including chiefly alder, several species of willow, dogwood, honeysuckle, and dwarf birch. Nine days after spraying some damage to the brush was noticed. However, an evaluation of the success of the spraying cannot be made until next summer.

The second area sprayed was a young pine plantation which was being suppressed by a tangle of scrubby hardwoods, and brush including hazel, cherry, prairie willow, aspen, birch, oak, and other species.

The chemical used on both areas was a mixture of 2,4-D and 2,4,5-T in oil. Three rates of application were tested for their relative effects.

If the tests demonstrate that undesirable brush species can be killed or their growth rates reduced without injury to the valuable conifers, the results may have great significance in the management of forest and farm areas in the Lake States where brush is often a serious problem. While spraying brush from the ground has been found to be very effective in many cases, aerial spraying may have the advantage of low cost of application. However, up to the present time the spraying techniques have required relatively large volumes of spray material per acre. The tests recently initiated involve low volumes of less than 5 gallons per acre of a highly concentrated solution which is dispersed as a fog by the airplane spraying equipment.

Consulting Foresters

Professional Services Offered by
Members of the Society of American Foresters

Woodsland Manager for Operating Firms

Bottomland Hardwoods
MISSISSIPPI DELTA

GULF STATES
Shortleaf, Slash, and Longleaf

KEITH CRANSTON *and Associates*
Leland, Mississippi

We now solicit work in your Pine lands
The Bottomland Hardwoods are part time work only

FOREST APPRAISALS FOREST TAXATION
GROWTH AND MANAGEMENT PLANS
FRANK J. LEMIEUX
Consulting Forester
25 Years' Experience in North and South America
833 WHITNEY BLDG., NEW ORLEANS 12, LA.

Reforestation Arboriculture
S. GAYLEY ATKINSON
Consulting Forester
Huntingdon Road
Huntingdon Valley, Pa.

SAMUEL A. NEWMAN
Forest Engineer
Timber Cruiser
P. O. Box 156
Everett, Washington

Complete Professional Service
WILLIAM A. EASTMAN, Jr.
Consulting Forester
Telephone SEneca 2814
410 J. Green Bldg. SEATTLE 1, WASH.

TOM REIMER
Forestry Consultant
1311 Whitney Ave., ALBANY, GA.
Phone 5283-W

POND & MOYER CO., INC.
Consulting Foresters
Estimates—Appraisals—Surveys
Machine Tree Planting Service
107 HOMESTEAD RD., ITHACA, N. Y.

TIMBER INVESTIGATIONS
CRUISING — APPRAISALS
SURVEYS — MAPS
LOGGING ENGINEERING
A. P. RUSSELL
Sumter South Carolina

Bennett Named Assistant

Dr. Hugh H. Bennett has been appointed special assistant to the Secretary of Agriculture, in charge of conservation and resource matters. Dr. Robert M. Salter has been named to succeed Dr. Bennett as chief of the Soil Conservation Service.

Dr. Bennett has been chief of the Soil Conservation Service since its creation in 1935 and recently was given exceptional permission to remain with the department after retirement age.

Dr. Salter has been chief, since 1942, of the Bureau of Plant Industry, Soils, and Agricultural Engineering. He has been directly engaged in all aspects of soil conservation for more than a quarter of a century and has spent most of his professional life working in the field of soil science.

In announcing Dr. Bennett's new position, Secretary Brannan stated that he looked forward to the use of Dr. Bennett's wide and rich experience on his staff as "the greatest honor he could bestow on a distinguished public servant rounding out 48 years of achievement for American farmers—and farmers in other parts of the world which have had the benefit of Dr. Bennett's imaginative work with the most basic of all resources, the soil."

Kimberly-Clark Graduate Research Fellowship

The University of Minnesota School of Forestry announces that Donald O. Prielipp, a 1951 graduate, has been awarded the Kimberly-Clark Corporation Graduate Research Fellowship in Forestry for 1951-52.

The fellowship provides for studies concentrated on forestry problems meriting special attention. This year's fellowship, said Dr. F. H. Kaufert, director of the School of Forestry, will be used to investigate decay in balsam fir. The results of these studies will be made available to the public and should be helpful to foresters, public owners of forest lands, and private owners of forest lands, and private owners in determining desirable cutting practices.

Prielipp, whose home is at Rothschild, Wis., was awarded a Trees For Tomorrow Freshmen Scholarship in 1947 and the Johnson Foundation Scholarship at the University of Minnesota for the 1950-51 school year. Prielipp was graduated from the University of Minnesota with distinction in June 1951.

Thomas W. Skuce (1898-1952)

Thomas W. Skuce, 54, forester and Member of the Society of American Foresters, died of a heart attack at his home in Washington, D. C. on October 3. He had just returned two days before from a two-year assignment with the Displaced Persons Commission in Germany.

A graduate of the Michigan State College, Mr. Skuce had served with the Conservation Commission of West Virginia for many years. In 1944 he went to Washington, D. C. with the U. S. Department of Agriculture, and a year later served in China with the United Nations Relief and Rehabilitation Administration. Later he was employed by the Chinese Nationalist government and the Food and Agriculture Organization of the United Nations in China.

Baudendistel Named to Flood Control Post

New chief of flood control surveys in the Pacific Northwest Forest and Range Experiment Station is Martin E. Baudendistel, who has been transferred from the Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mont. where he has been in charge of flood control survey work. He succeeds Dr. Harold G. Wilm who recently was named chief of the division of forest influences of the U. S. Forest Service in Washington, D. C.

Baudendistel has a bachelor of science degree from the New York State College of Forestry. He earned graduate credits at the same school before entering the forest service in 1933.

Sequoia Widely Planted

A recent listing from the U. S. high command shows 476 specimens of *Sequoia gigantea* in Germany, according to the Rare Plant Club of Kentfield, Calif. These specimens range up to 85 years old.

In October, California's Governor Earl Warren presented one *Sequoia gigantea* to the State of Tennessee in connection with the Gatlinburg Governor's Conference. The tree was planted near Chief Sequoyah's cabin.

GROW TREES
FOR XMAS TREES AND FORESTRY
Fir, Pine and Spruce in Variety
Seedlings and Transplants
Write for Price List
Suncrest Evergreen Nurseries
P. O. Box. 643, Johnstown, Pa.

BAILEY'S
Air pressure tree marking guns
Tested and proven by leading foresters
Bailey Tree Marking Paints
"Best of Course"
Used throughout the entire country
BAILEY
PAINT and VARNISH
MANUFACTURERS
EL DORADO, ARKANSAS

Champion Portable Fire Pumps

Darley Portables Must Be Good! State of Minn. Forestry Dept. Has 45 Champions in Service!
Darley Champion Portable Fire Pumps were selected over other makes by the State of Minnesota for hard service in the State Forestry Department.
Darley Engineering Brings You More Water and Higher Pressures with Champion Lightweight Portables.
Capacity up to 250 gallons per minute. Pressures up to 125 lbs.
Write for 108 page catalog of Fire Equipment. Also 44 page booklet of Fire Pumps and Fire Trucks.
W. S. DARLEY & CO., CHICAGO 12
Manufacturers of Champion Fire Pumps and Champion Fire Apparatus

FORESTRY TERMINOLOGY

A Glossary of Technical Terms Used in Forestry

New, Revised, Enlarged 1950 Edition

PRICE $3 POSTPAID

A *MUST* for every forester's desk or library. Included are definitions of all terms that the practicing forester uses in his daily work and encounters in forestry literature. Order today.

Society of American Foresters
Mills Building, Washington 6, D. C.

Chapman Chemical Company Graduate Research Fellowship

The School of Forestry, University of Minnesota, has been given a graduate research fellowship in the field of wood technology by the Chapman Chemical Company of Memphis, Tenn. Work under the fellowship will be in wood preservation. The recipient of the fellowship for 1951-52 is Caroll M. Thureen, a 1948 graduate of the School of Forestry, who is returning for graduate study after two years with the Valentine Clark Corporation of St. Paul.

In announcing the receipt of the fellowship and its award, F. H. Kaufert, director of the School of Forestry, states that A. Dale Chapman, president of the Chapman Chemical Company is a 1929 graduate of the university. The company manufactures and markets wood preservatives and agricultural chemicals.

Soil Science Foundation

The University of California has announced the establishment in the College of Agriculture of the M. Theodore Kearney Foundation of Soil Science. The new foundation will be endowed with the proceeds of the bequest of Mr. Kearney, prominent rancher in the Fresno area in the latter part of the last century, who died in 1906, leaving to the university his estate which included the famous Kearney Vineyard in Fresno County. The endowment now amounts to $2,268,000.

The foundation will be devoted to the advancement of knowledge of soil science, including soil-water-plant relations, through basic physical, chemical, biological, and hydrological research, with particular reference to arid and semi-arid farming regions. It will also be designed to strengthen the services of the university in the education and training of soil scientists and teachers of soil science.

WANTED

Executive in Land Department

Executive position open in land department of large company. Must be graduate forester, experienced in forest operations as pertaining to Southern pulp and paper industry, and possess outstanding administrative qualities. In first letter please provide usual information called for on an employment application form.

Address "Forester", P. O. Box 241, Atlanta, Ga.

IMPORTANT

Tree Pests

OF THE NORTHEAST

(Revised Edition)

Prepared by Committee on Tree Pest Leaflets,
New England Section, Society of American Foresters

Approx. 224 pp. 84 illus. Paper cover. Price $2 plus shipping charges—15 cents for single copy. 5 cents for each additional copy.

First edition published in 1940 included the first 50 Tree Pest Leaflets published with indices to most trees, insects, and diseases. The *new* edition has been largely rewritten and brought up to date and includes 55 subjects. A list of scientific and common names of trees is added.

Send orders to

TREE PEST LEAFLETS
HILLSBORO, N. H.

FORESTER

Seal-Tite

DRIP-TORCH

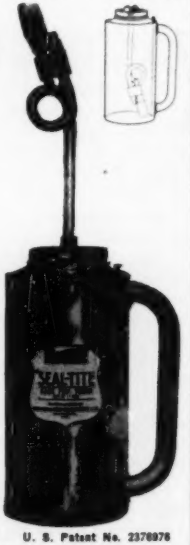
Proved superior in over 6 years of field service

No Flash-back
No fuel slopping
No air pump
No pressure build-up
No explosive vapors
No pre-heating
Instant operation

SAFE • EFFICIENT
RELIABLE • ECONOMICAL

Burns Diesel Fuel or Stove Oil
1¼ Gallon Capacity
Weight loaded 16 pounds

Approved for use by U. S. Forest Service



U. S. Patent No. 2376976

Write for descriptive folder and price list.

WESTERN FIRE EQUIPMENT CO.
69 Main St., SAN FRANCISCO, California

The American Forestry Series

WALTER MULFORD
Consulting Editor

Allen—
AN INTRODUCTION TO AMERICAN FORESTRY. 2nd edition $5.00

Baker—
THE THEORY AND PRACTICE OF SILVICULTURE $6.00
PRINCIPLES OF SILVICULTURE $5.00

Boyce—
FOREST PATHOLOGY. 2nd edition $6.50

Brown, Panshin, and Forsaith—
TEXTBOOK OF WOOD TECHNOLOGY. Volume I. $6.50
Volume II. ..... In press

Bruce and Schumacher—
FOREST MENSURATION. 3rd edition. $5.00

Chapman and Meyer—
FOREST VALUATION $6.00
FOREST MENSURATION $5.00

Clawson—
THE WESTERN RANGE LIVESTOCK INDUSTRY $5.50

Doane, Van Dyke, Chamberlin, and Burke—
FOREST INSECTS $6.00

Guise—
THE MANAGEMENT OF FARM WOODLANDS. 2nd edition $4.25

Harlow and Harrar—
TEXTBOOK OF DENDROLOGY. 3rd edition $5.25

Kittredge—
FOREST INFLUENCES $5.50

Marquis—
ECONOMICS OF PRIVATE FORESTRY $3.50

Matthews—
MANAGEMENT OF AMERICAN FORESTS $6.00
COST CONTROL IN THE LOGGING INDUSTRY $5.00

Panshin, Harrar, Baker, and Proctor—
FOREST PRODUCTS $6.00

Preston—
FARM WOOD CROPS $4.00

Stoddart and Smith—
RANGE MANAGEMENT $6.00

Trippensee—
WILDLIFE MANAGEMENT $5.50

Wackerman—
HARVESTING TIMBER CROPS $5.50

Send for copies on approval

McGraw-Hill Book Company, Inc.
330 West 42nd Street New York 18, N. Y.

New!

LIGHTWEIGHT 9 HP DISSTON INTERMEDIATE CHAIN SAW that handles any woodcutting job!

Where big production—and big paychecks—depend on steady and regular going, that's where you'll depend on Disston. Lots of lightweight power is what's needed for day-in, day-out going in the big woods—and that's what the Disston Intermediate Saw gives you!

HERE'S the power chain saw you've been waiting for—the new 9 hp, 2 cylinder Disston Intermediate Chain Saw, the DA-211. This rugged, dependable production tool will never wear you out. Its 9 big horses are capable of handling any woods job, yet its balanced light weight makes it easy to heft. It's made to deliver years of satisfying, trouble-free cutting power. That means it stays out of the shop and remains in the woods, where it belongs.

Get free illustrated literature, complete with technical information. Just fill in the coupon and mail it today.

HENRY DISSTON & SONS, INC.

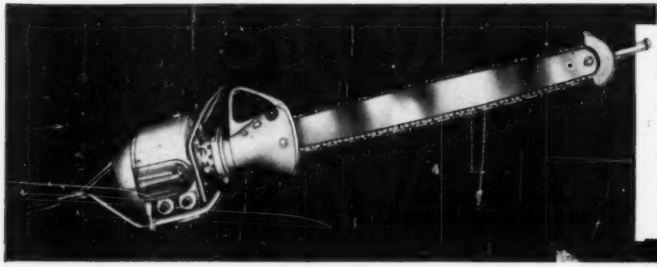
PHILADELPHIA 35, PA., U.S.A. *In Canada, write:* 2-20 Fraser Ave., Toronto 3, Ont.

Lay that DA-211 against a log, and let the chips fall where they may! It's a pleasure to feel those 9 horses bite evenly and steadily through the wood. Remember, too, you need no other saw than a Disston Intermediate for a complete all-round woods job.

MAKERS OF THE FAMOUS DISSTON HAND SAWS

LOOK AT THESE GREAT MADE-TO-LAST FEATURES...

2 cylinders, 9 horsepower • Perfect balance—no vibration • Automatic clutch • Automatic chain oiler • Dependable float-feed carburetor • Simplified, positive controls • Self-rewinding starter • Rugged magnesium castings • Available with "L" or "C" chain • 2' to 7' (incl.) new narrow-profile slotted rails • Positive stop switch • Oversize fan for cool operation • Transmission swivels to any position—can be easily removed



Henry Disston & Sons, Inc. (Adv. Dept.)
Philadelphia 35, Pa., U.S.A.

Please send me information on the 9 hp DA-211 Disston Intermediate Chain Saw.

Name.....

Street.....

City..... State.....

20 L